



## United States Department of the Interior

FISH AND WILDLIFE SERVICE  
Sacramento Fish and Wildlife Office  
2800 Cottage Way, Room W-2605  
Sacramento, California 95825-1846



IN REPLY REFER TO:  
1-1-04-F-0140

JUL 30 2004

### Memorandum

To: Operations Manager, Bureau of Reclamation, Central Valley Operations Office, Sacramento, California

From: Field Supervisor, U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, Sacramento, California

Subject: Formal and Early Section 7 Endangered Species Consultation on the Coordinated Operations of the Central Valley Project and State Water Project and the Operational Criteria and Plan

This is in response to the Bureau of Reclamation's (Reclamation) March 22, 2004, request for formal consultation with the U.S. Fish and Wildlife Service (Service) on the coordinated operations of the Central Valley Project (CVP) and State Water Project (SWP) and the Operating Criteria and Plan (OCAP) in California. The OCAP describes the coordinated operations of the CVP and SWP. Reclamation and the California Department of Water Resources (DWR) operate the CVP and SWP through the Coordinated Operations Agreement (COA) (Reclamation 2004). The COA is the federal nexus for consultation on SWP operations under section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act). Your request was received in our office on March 22, 2004. This document represents the Service's biological opinion on the effects of the action to the threatened delta smelt (*Hypomesus transpacificus*) and its critical habitat in accordance with the Act.

Reclamation also requested consultation on the endangered riparian brush rabbit (*Sylvilagus bachmani riparius*), the endangered riparian woodrat (*Neotoma fuscipes riparia*), the endangered salt marsh harvest mouse (*Reithrodontomys raviventris*), the endangered California clapper rail (*Rallus longirostris*), the threatened giant garter snake (*Thamnophis gigas*), the threatened California red-legged frog (*Rana aurora draytonii*), the threatened valley elderberry longhorn beetle (*Desmocercus californicus dimorphus*), the endangered soft bird's beak (*Corylanthus mollis ssp. mollis*) and the endangered Suisun thistle (*Cirsium hydrophilum var. hydrophilum*). The Service concurs with Reclamation's determination that the coordinated operations of the CVP and SWP and the OCAP for formal and early consultation are not likely to adversely affect these species.



TAKE PRIDE

No additional effects are expected to the threatened bald eagle (*Haliaeetus leucocephalus*) as a result of implementation of the formal or the early consultation beyond those analyzed in the Service's *Formal Endangered Species Act Consultation on Effects of Implementing Long Term Operational Criteria and Plan for Central Valley Project Reservoirs* for the bald eagle dated February 12, 1993 (Service file # 1-1-93-F-10). Therefore, the Service opinion dated February 12, 1993 still applies for effects to the bald eagle.

This biological opinion is based on information provided in Reclamation's biological assessment dated June 30, 2004, the CH2MHill Trinity document dated November 5, 2003, and all associated enclosures. A complete administrative record is on file at the Sacramento Fish and Wildlife Office (SFWO).

This biological opinion covers formal and early consultation for the operations of the CVP and SWP. The formal consultation effects described in this biological opinion cover the proposed 2020 operations of the CVP including the Trinity River Mainstem ROD (Trinity ROD) flows on the Trinity River, the increased water demands on the American River, the delivery of CVP water to the proposed Freeport Regional Water Project (FRWP), water transfers, the long term Environmental Water Account (EWA), the operation of the Tracy Fish Facility, and the operation of the SWP-CVP intertie. The effects of operations of the SWP are also included in this opinion and include the operations of the North Bay Aqueduct, the Suisun Marsh Salinity Control Gates, the Skinner Fish Facility and water transfers.

Early consultation effects include the effects of operations of components of the South Delta Improvement Program (SDIP). These operations include pumping of 8500 cubic feet per second (cfs) at the SWP and Banks Pumping Plant (hereafter referred to as 8500 Banks), permanent barrier operations in the South Delta, the long term EWA, water transfers, and CVP and SWP operational integration. There are two separate effects sections in this biological opinion, one for Formal Consultation and one for Early Consultation. In addition, there is an incidental take for formal consultation and a preliminary incidental take for early consultation.

### **Early Consultation Process**

This biological opinion includes an effects determination and take statement for the formal consultation items described above. This biological opinion also includes a preliminary effects determination and take statement for the early consultation items described above. An Early Consultation as stated in the regulations "is designed to reduce the likelihood of conflicts between listed species or critical habitat and proposed actions and occurs prior to the filing of and application for a Federal permit or license." The early consultation will result in a preliminary biological opinion except that the incidental take statement provided for the early consultation does not constitute authority to take listed species. Once the South Delta Action Specific Implementation Plan (ASIP) is completed, the Service will re-examine the project description and effects in the ASIP and in this opinion. If the project description and effects to the delta smelt are the same as in the early consultation effects section of this biological opinion, the Service will formalize the early consultation portion of this biological opinion. If there are additional effects or project elements that are not addressed in the early consultation section of this biological opinion, Reclamation and DWR will reinitiate on this biological opinion to cover

smelt effects described in the South Delta ASIP.

### CONSULTATION HISTORY

On February 12, 1993, the Service issued its biological opinion on the Long Term Operations Criteria and Plan for CVP Reservoirs for the bald eagle, salt marsh harvest mouse and California clapper rail (Service file #1-1-93-F-10).

On May 23, 1993, the Service issued a biological opinion on the Operations Criteria and Plan for the bald eagle, salt marsh harvest mouse and the California clapper rail (Service file #1-1-93-F-32).

On May 26, 1993, the Service issued the *Formal Consultation on Central Valley Project Operations Criteria and Plan for 1993: Effects on Delta Smelt* (Service file #1-1-93-F-32).

On February 4, 1994, the Service issued its *Formal Consultation on the 1994 Operation of the Central Valley Project and State Water Project: Effect on Delta Smelt*.

On November 2, 1994, the Service issued its *Formal Endangered Species Consultation on the Environmental Protection Agency's proposed Water Quality Standards for the San Francisco Bay/Sacramento-San Joaquin Rivers and Delta* (Service file #1-1-93-F-61).

On March 6, 1995, the Service issued its *Formal Consultation and Conference on Effects of Long-term Operation of the Central Valley Project and State Water Project on the Threatened Delta Smelt, Delta Smelt Critical Habitat, and Proposed Threatened Sacramento Splittail* (Service File #1-1-94-F-70).

On September 14, 1995, the Service issued its *Informal Endangered Species Consultation on the Replacement of the U.S. Environmental Protection Agency's Water Quality Standards for the San Francisco Bay/Sacramento-San Joaquin Rivers and Delta with the California State Water Resources Control Board's Water Quality Control Plan for the Bay/Delta* (Service file #1-1-95-I-1509).

Starting in November 2002, the Service, along with other fishery and project agencies met monthly to discuss the development of the biological assessment.

On February 12, 2003, the Service submitted the document *Information Needs for Consultations on Delta smelt and Sacramento Splittail for the South Delta Improvement Program and the Central Valley Project and State Water Project Operations* to Reclamation and DWR which provided information that the Service needed to have included in Reclamation's biological assessment.

On April 25, 2003, the Service submitted the document *Additional Information Needs for Consultation on Delta smelt and Sacramento Splittail for the Central Valley Project and State*

*Water Project* to Reclamation which requested additional information to be included in the biological assessment.

On May 6, 2003, the Service submitted the document *Request for Additional Information to Initiate Formal Consultation for Central Valley Project Water Deliveries to Sacramento County Water Agency in Sacramento County, and East Bay Municipal Utility District in Contra Costa, California* to Reclamation.

On July 23, 2003, the Service submitted the document *Service Comments on the Bureau of Reclamation's Draft long-Term Central Valley Project Operations, Criteria and Plan and Biological Assessment*.

On September 2003, the Service, along with other fishery and project agencies began meeting weekly to develop the project description and the effects sections of the biological assessment.

On February 13, 2004, the Service received a draft of the biological assessment for the coordinated operations of the CVP and SWP and the OCAP

On March 15, 2004, the Service received the Reclamation's March 15, 2004, request for formal and early consultation and transmittal of their biological assessment on the coordinated operations of the CVP and SWP and the OCAP. However, this letter did not include a biological assessment.

On March 22, 2004, the Service received the biological assessment from Reclamation on the coordinated operations of the CVP and SWP and the OCAP. Also on March 22, 2004, the Service received Reclamation's February 2004, *Long-term Central Valley Project and State Water Project Operations Criteria and Plan Biological Assessment for Terrestrial Species*. The Service received on March 22, 2004, the Department of Water Resources' *Long Term Central Valley Project Operating Criteria and Plan Biological Assessment for Terrestrial Species Protected Under the State Endangered Species Act*.

On May 24, 2004, the Service received an updated version of the biological assessment and the OCAP from Reclamation which included separate effects for the early and formal consultation.

On June 30, 2004, the Service received an updated version of the biological assessment from Reclamation.

## **BIOLOGICAL OPINION**

### **Description of Proposed Action**

#### **Introduction**

Reclamation and California Department of Water Resources (DWR) propose to operate the CVP and SWP (collectively the Project) to divert, store, and convey Project water consistent with

applicable law. These operations are summarized in this Biological Assessment (BA) and are described in further detail in the CVP-OCAP.

### **The Proposed Action**

The proposed action is to continue to operate the CVP and SWP in a coordinated manner. In addition to current day operations, several future actions are to be included in this consultation. These actions are: (1) increased flows in the Trinity River, (2) 8500 Banks, (3) permanent barriers operated in the South Delta, (4) an intertie between the California Aqueduct (CA) and the Delta-Mendota Canal (DMC), (5) a long-term EWA, (6) delivery of CVP water to the FRWP, and (7) various operational changes that are identified in this project description. Some of these items will be part of early consultation including 8500 Banks, permanent barriers and the long-term EWA. These proposed actions will come online at various times in the future. Thus, the proposed action is continued operation of the Project without these actions, and operations as they come online.

The actions listed in the preceding paragraph are not being implemented at present; however, they are part of the future proposed action on which Reclamation is consulting. Only the operations associated with the proposed activities are addressed in this consultation; i.e., the activities do not include construction of any facilities to implement the actions. All site-specific/localized activities of the actions such as construction/screening and any other site-specific effects will be addressed in separate action specific section 7 consultations. Table 1 summarizes the differences between current operational actions and future operational actions to be covered by this consultation.

**Table 1 Proposed future changes in operational actions for consultation.**

<b>Area of Project</b>	<b>Circa 1997</b>	<b>Today 2004</b>	<b>Future 2030</b>
Trinity & Whiskeytown	340,000 af	368,600-452,600 af	368,600- 815,000 af
Shasta/Sacramento River	Red Bluff Diversion Dam (RBDD) 8 months gates out	Same	Same
Oroville and Feather River	Same	Same	Same
Folsom and American River	Current Demands	Current Demands	Build out of demands and Freeport Regional Water Project
New Melones and Stanislaus River	Interim Plan of Operations Guidance	Same	Same
Friant	Same	Same	Same
Sacramento-San Joaquin Delta	2001 Demands	2001 Demands	2020 Demands
Suisun March	Same	Same	Same
WQCP	D-1641	D-1641	Same
COA	1986 Guidance	1986 Guidance	Integrated Operations
CVPIA	May 9, 2003 Decision	May 9, 2003 Decision	Same
CALFED	None	EWA	Same
Banks	6680 cfs & Temp Barriers	6680 cfs & Temp Barriers	8500 Banks and Permanent barriers
Tracy	Max of 4600 cfs in summer	Max of 4600 cfs in summer	Intertie

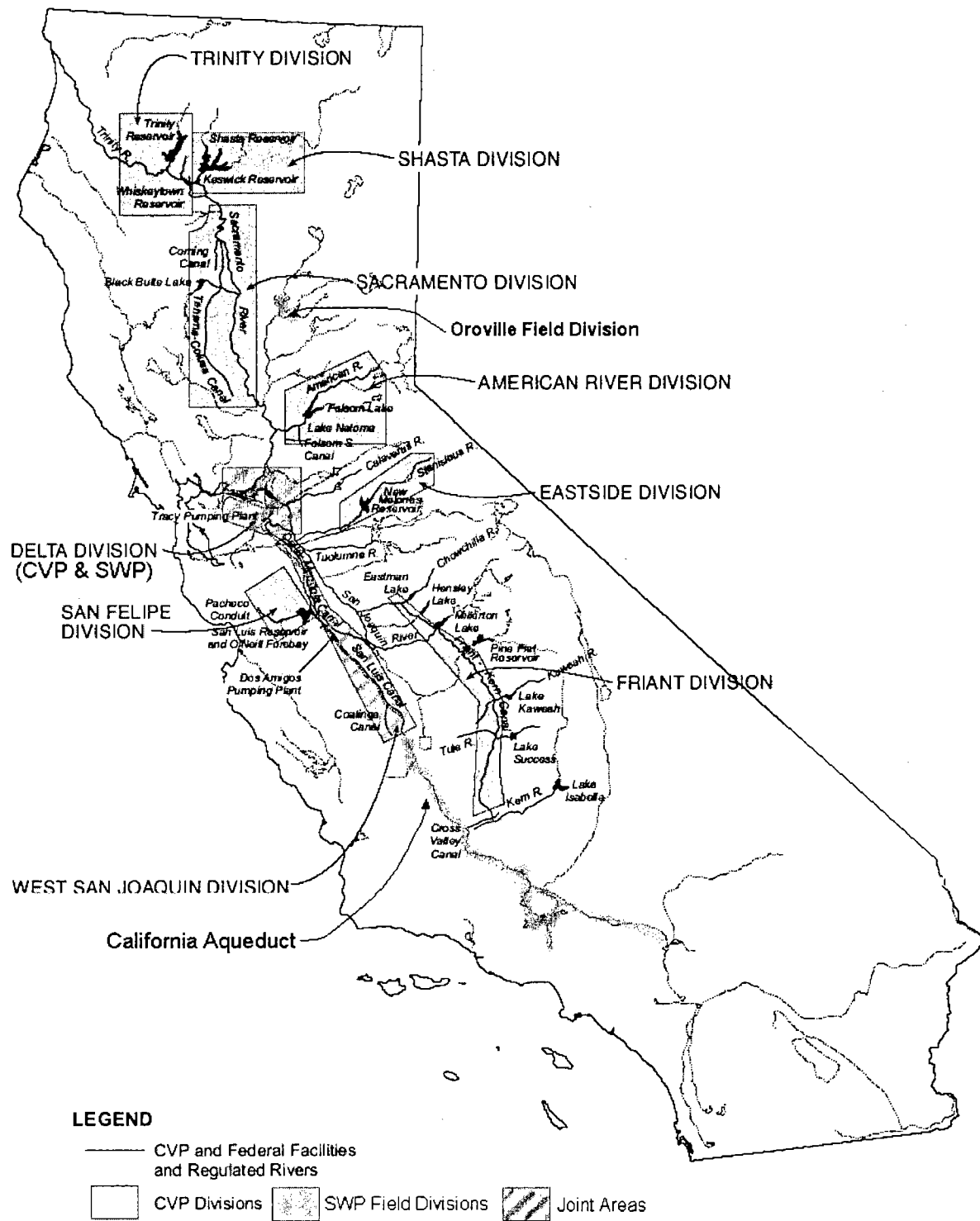


Figure A: CVP and SWP Service Areas

## **Coordinated Operation of the CVP and SWP**

The CVP and SWP use a common water supply in the Central Valley of California. The DWR and Reclamation (collectively referred to as Project Agencies) have built water conservation and water delivery facilities in the Central Valley in order to deliver water supplies to affected water rights holders as well as project contractors. The Project Agencies' water rights are conditioned by the California State Water Resources Control Board (SWRCB) to protect the beneficial uses of water within each respective project and jointly for the protection of beneficial uses in the Sacramento Valley and the Sacramento-San Joaquin Delta Estuary Delta. The Project Agencies operate the CVP and SWP to meet these requirements through the Coordinated Operations Agreement (COA) (Reclamation 2004).

The COA defines the project facilities and their water supplies, sets forth procedures for coordination of operations, identifies formulas for sharing joint responsibilities for meeting Delta standards and other legal uses of water, identifies how unstored flow will be shared, sets up a framework for exchange of water and services between the Projects, and provides for periodic review every 5 years.

The CVP and the SWP use the Sacramento River and the Delta as common conveyance facilities. Reservoir releases and Delta exports must be coordinated to ensure each project achieves its share of benefit from shared water supplies and bears its share of joint obligations to protect beneficial uses.

## **Implementing the COA**

### ***Obligations for In-basin Uses***

In-basin uses are defined in the COA as legal uses of water in the Sacramento Basin, including the water required under the SWRCB Decision 1485 (D-1485) (Reclamation 2004) Delta standards (D-1485 ordered the CVP and SWP to guarantee certain conditions for water quality protection for agricultural, municipal and industrial [M&I], and fish and wildlife use). Each project is obligated to ensure water is available for these uses, but the degree of obligation is dependent on several factors and changes throughout the year.

Balanced water conditions are defined in the COA as periods when it is agreed that releases from upstream reservoirs plus unregulated flows approximately equals the water supply needed to meet Sacramento Valley in-basin uses plus exports. Excess water conditions are periods when it is agreed that releases from upstream reservoirs plus unregulated flow exceed Sacramento Valley in-basin uses plus exports. Reclamation's Central Valley Operations Office (CVOO) and DWR's SWP Operations Control Office jointly decide when balanced or excess water conditions exist.

During excess water conditions, sufficient water is available to meet all beneficial needs, and the CVP and SWP are not required to supplement the supply with water from reservoir storage. Under Article 6(g), Reclamation and DWR have the responsibility (during excess water conditions) to store and export as much water as possible, within physical and contractual limits.

In these Studies, accountability is not required. However, during balanced water conditions, the Projects share the responsibility in meeting in-basin uses. Balanced water conditions are further defined according to whether water from upstream storage is required to meet Sacramento Valley in-basin use or unstored water is available for export.

When water must be withdrawn from reservoir storage to meet in-basin uses, 75 percent of the responsibility is borne by the CVP and 25 percent is borne by the SWP<sup>1</sup>. When unstored water is available for export (i.e., Delta exports exceed storage withdrawals while balanced water conditions exist), the sum of CVP stored water, SWP stored water, and the unstored water for export is allocated 55/45 to the CVP and SWP, respectively.

### ***Accounting and Coordination of Operations***

Reclamation and DWR coordinate on a daily basis to determine target Delta outflow for water quality, reservoir release levels necessary to meet in-basin demands, schedules for joint use of the San Luis Unit facilities, and for the use of each other's facilities for pumping and wheeling. During balanced water conditions, daily accounts are maintained of the CVP and SWP obligations. This accounting allows for flexibility in operations and avoids the necessity of daily changes in reservoir releases that originate several days travel time from the Delta. It also means adjustments can be made "after the fact" rather than by prediction for the variables of reservoir inflow, storage withdrawals, and in-basin uses.

The accounting language of the COA provides the mechanism for determining the responsibility of each project; however, real time operations dictate actions. For example, conditions in the Delta can change rapidly. Weather conditions combined with tidal action can quickly affect Delta salinity conditions, and therefore, the Delta outflow objective. If, in this circumstance, it is decided the reasonable course of action is to increase upstream reservoir releases, then the response will likely be to increase Folsom releases first. Lake Oroville water releases require about three days to reach the Delta, while water released from Lake Shasta requires 5 days to travel from Keswick to the Delta. As water from the other reservoirs arrives in the Delta, Folsom releases could be adjusted downward. Any imbalance in meeting each project's obligation would be captured by the COA accounting.

Reservoir release changes are one means of adjusting to changing in-basin conditions. Changes in Delta outflow can also be immediately achieved by increasing or decreasing project exports. As with changes in reservoir releases, imbalances in meeting project obligations are counted in the COA accounting.

During periods of balanced water conditions, when real-time operations dictate project actions, an accounting procedure tracks the water obligations of the CVP and SWP. The Projects maintain a daily and accumulated accounting. The account represents the imbalance resulting from actual coordinated operations compared to the COA-defined sharing of obligations and supply. The project that is "owed" water (i.e., the project that provided more or exported less than its COA-defined share) may request the other project adjust its operations to reduce or

---

<sup>1</sup> These percentages were derived from negotiations between Reclamation and DWR

eliminate the accumulated account within a reasonable time.

The duration of balanced water conditions varies from year to year. Some very wet years have had no periods of balanced conditions, while very dry years may have had long continuous periods of balanced conditions, and still other years may have had several periods of balanced conditions interspersed with excess water conditions. Account balances continue from one balanced water condition through the excess water condition and into the next balanced water condition. When the project that is owed water enters into flood control operations, at Shasta or Oroville, the accounting is zeroed out for that respective project.

### **Changes in Operations Coordination Environment since 1986**

Implementation of the COA has evolved continually since 1986 as changes have occurred to CVP and SWP facilities, to project operations criteria, and to the overall physical and regulatory environment in which the operations coordination takes place. Since 1986, new facilities have been incorporated into the operations that were not part of the original COA. New water quality and flow standards (D-164T) have been imposed by the SWRCB; the Central Valley Project Improvement Act (CVPIA) has changed how the CVP is operated; and finally, the Act responsibilities have effected both the CVP and SWP operations. The following is a list of significant changes that have occurred since 1986. Included after each item is an explanation of how it relates to the COA and its general effect on the accomplishments of the Projects.

#### ***Sacramento River Temperature Control Operations***

Temperature operations have constrained the pattern of storage and withdrawal of storage at Shasta, Trinity, and Whiskeytown, for the purpose of improving temperature control. They have also constrained rates of flow, and changes in rates of flow below Keswick Dam in keeping with temperature requirements. Such constraints have reduced the CVP's capability to respond efficiently to changes in Delta export or outflow requirements. Periodically, temperature requirements have caused timing of the CVP releases to be mismatched with Delta export capability, resulting in loss of water supply. On occasion, and in accordance with Articles 6(h) and 6(i) of the COA, the SWP has been able to export water released by the CVP for temperature control in the Sacramento River.

#### ***Bay-Delta Accord, and Subsequent SWRCB Implementation of D-1641***

The December 1994 Bay-Delta Accord (Accord) committed the CVP and SWP to a set of Delta habitat protective objectives that were eventually incorporated into the 1995 Water Quality Control Plan (WQCP) (Reclamation 2004), and later, along with Vernalis Adaptive Management Program (VAMP) (Reclamation 2004), were implemented by D-1641. The actions taken by the CVP and SWP in implementing D-1641 significantly reduced the export water supply of both Projects. Article 11 of the COA describes the options available to the United States for responding to the establishment of new Delta standards.

The first option is to amend the COA to provide for continued implementation to accomplish the purposes of the 1986 COA. Although the CVP and SWP continue to be operated in coordination to meet D-1641, neither an amendment of the COA nor an evaluation of the new Delta standards

(for consistency with Congressional directives) has been undertaken. Significant new elements in the D-1641 standards include: (1) the X2 standards, (2) export to inflow (E/I) ratios, (3) Real-time Delta Cross Channel (DCC) operation, (4) San Joaquin flow standards, and (5) recognition of the CALFED Operations Coordination Group (Ops Group) process for flexibility in applying or relaxing certain standards.

### ***Freeport Regional Water Project***

The FRWP will be a new facility that will divert up to a maximum of about 300 cfs from the Sacramento River near Freeport for Sacramento County Water Agency (SCWA) and East Bay Municipal Utility District (EBMUD). EBMUD will divert water pursuant to its amended contract with Reclamation. The County will divert using its water rights and its CVP contract supply. This facility was not in the 1986 COA, and the diversions will result in some reduction in Delta export supply for both the CVP and SWP contractors. Pursuant to an agreement between Reclamation, DWR, and the CVP and SWP contractors in 2003 (Reclamation 2004), diversions to EBMUD will be treated as an export in the COA accounting and diversions to SCWA will be treated as an in-basin use.

### ***North Bay Aqueduct***

North Bay Aqueduct is a SWP feature that can convey up to about 175 cfs diverted from the SWP's Barker Slough Pumping Plant. North Bay Aqueduct Diversions are conveyed to Napa and Solano Counties. Pursuant to an agreement between Reclamation, DWR, and the CVP and SWP contractors in 2003, a portion of the SWP diversions will be treated as an export in COA accounting.

### ***Loss of 195,000 af of D-1485 Condition 3 Replacement Pumping***

The 1986 COA affirmed the SWP's commitment to provide replacement capacity to the CVP to make up for May and June pumping reductions imposed by SWRCB D-1485 in 1978. In the evolution of COA operations since 1986, D-1485 was superseded and SWP growth and other pumping constraints reduced available surplus capacity. The CVP has not received replacement pumping since 1993. Since then there have been (and in the current operations environment there will continue to be) many years in which the CVP will be limited by insufficient Delta export capacity to convey its water supply. The loss of the up to 195,000 af of replacement pumping has diminished the accomplishments anticipated by the CVP under the 1986 COA.

### ***Periodic Review of the COA***

The language of the COA incorporates a provision for the periodic review of the Agreement. Article 14a of the COA specifies the parties to review operations every 5 years.

The Agreement proceeds to state that the parties shall:

- Compare the relative success each party has had in meeting its objectives
- Review operation studies supporting the COA
- Assess the influence of the factors and procedures of Article 6 in meeting each party's future objectives

Article 14a further states, "The parties shall agree upon revisions, if any, of the factors and

procedures in Article 6, Exhibits B and D, and the Operation Study used to develop Exhibit B.” Beginning in 1995, and continuing under D-1641, the Projects have been operating to meet the revised Delta standards. The changes that have occurred to the CVP and SWP since 1986 suggest a COA review would be appropriate. The August 2000 CALFED Record of Decision (CALFED ROD) (Reclamation 2004) included as an “Implementation Commitment” that DWR and Reclamation intend to modify the 1986 COA to reflect the many changes in regulatory standards, operating conditions, and new project features such as EWA, that have evolved. Should that process indicate a change in the coordinated operation of the CVP and SWP, a review will be completed to determine the need to re-initiate consultation under Section 7 of the Act.

### **SWRCB D-1641**

The SWRCB imposed a myriad of constraints upon the operations of the CVP and SWP in the Delta. With Water Rights Decision 1641, the SWRCB implements the objectives set forth in the SWRCB 1995 Bay-Delta WQCP and imposes flow and water quality objectives upon the Projects to assure protection of beneficial uses in the Delta. The SWRCB also grants conditional changes to points of diversion for each project with D-1641.

The various flow objectives and export restraints are designed to protect fisheries. These objectives include specific outflow requirements throughout the year, specific export restraints in the spring, and export limits based on a percentage of estuary inflow throughout the year. The water quality objectives are designed to protect agricultural, municipal and industrial, and fishery uses and vary throughout the year and by the wetness of the year.

Figure 1 (and footnotes) summarizes the flow and quality objectives in the Delta and Suisun Marsh for the Projects from D1641. These objectives will remain in place until such time that the SWRCB revisits them per petition or as a consequence to revisions to the SWRCB WQCP for the Bay-Delta (which is to be revisited periodically).

On December 29, 1999, SWRCB adopted and then revised (on March 15, 2000) D-1641, amending certain terms and conditions of the water rights of the SWP and CVP. D-1641 substituted certain objectives adopted in the WQCP for water quality objectives that had to be met under the water rights of the SWP and CVP. In effect, D-1641 obligates the SWP and CVP to comply with the objectives in the WQCP. The requirements in D-1641 address the standards for fish and wildlife protection, M&I water quality, agricultural water quality, and Suisun Marsh salinity. D-1641 also authorizes SWP and CVP to jointly use each other’s points of diversion in the southern Delta, with conditional limitations and required response coordination plans. D-1641 modified the Vernalis salinity standard under SWRCB Decision 1422 to the corresponding Vernalis salinity objective in the WQCP. The criteria imposed upon the CVP and SWP are summarized in Figure 1 (Summary Bay-Delta Standards and Footnotes for Summary Bay-Delta Standards), and Figure 1 (CVP/SWP Map).

Summary Bay-Delta Standards												
Contained in D-1641												
CRITERIA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
<b>FLOW/OPERATIONAL</b>												
• Fish and Wildlife												
SWP/CVP Export Limits				1,500 cfs <sup>[1]</sup>								
Export/Inflow Ratio <sup>[2]</sup>	65%		35% of Delta Inflow <sup>[3]</sup>					65% of Delta Inflow				
Minimum Delta Outflow	1-9							3,000 - 8,000 cfs <sup>[4]</sup>				
Habitat Protection Outflow			7,100 - 29,200 cfs <sup>[5]</sup>									
Salinity Starting Condition <sup>[6]</sup>		[6]										
River Flows:												
@ Rio Vista									3,000 - 4,500 cfs <sup>[7]</sup>			
@ Vernalis - Base		710 - 3,420 cfs <sup>[8]</sup>				[9]						
- Pulse				[9]					+28TAF			
Delta Cross Channel Gates	[10]		Closed								Conditional <sup>[10]</sup>	
<b>WATER QUALITY STANDARDS</b>												
• Municipal and Industrial												
All Export Locations									≤ 250 mg/l Cl			
Contra Costa Canal									150 mg/l Cl for the required number of days <sup>[12]</sup>			
• Agriculture												
Western/Interior Delta									Max 14-day average EC mmhos/cm <sup>[13]</sup>			
Southern Delta <sup>[14]</sup>		1.0 mS			30 day running avg EC 0.7 mS				1.0 mS			
• Fish and Wildlife												
San Joaquin River Salinity <sup>[15]</sup>				14-day avg: 0.44 EC								
Suisun Marsh Salinity <sup>[16]</sup>	12.5 EC	8.0 EC		11.0 EC					19.0 EC	[17]	15.5 EC	
<sup>[17]</sup> See Footnotes												

Figure 1 Summary Bay Delta Standards (Also See Footnotes)

## Footnotes

[1] Maximum 3-day running average of combined export rate (cfs) which includes Tracy Pumping Plant and Clifton Court Forebay Inflow less Byron-Bethany pumping.

Year Type	All
Apr15 - May15*	The greater of 1,500 or 100% of 3-day avg. Vernalis flow

\* This time period may need to be adjusted to coincide with fish migration. Maximum export rate may be varied by CalFed Op's group.

[2] The maximum percentage of average Delta inflow (use 3-day average for balanced conditions with storage withdrawal, otherwise use 14-day average) diverted at Clifton Court Forebay (excluding Byron-Bethany pumping) and Tracy Pumping Plant using a 3-day average. (These percentages may be adjusted upward or downward depending on biological conditions, providing there is no net water cost.)

[3] The maximum percent Delta inflow diverted for Feb may vary depending on the January BRl.

Jan BRl	Feb exp. limit
≤ 1.0 MAF	45%
between 1.0 & 1.5 MAF	35%-45%
> 1.5 MAF	35%

[4] Minimum monthly average Delta outflow (cfs). If monthly standard ≤ 5,000 cfs, then the 7-day average must be within 1,000 cfs of standard, if monthly standard > 5,000 cfs, then the 7-day average must be ≥ 80% of standard.

Year Type	All	W	AN	BN	D	C
Jan	4,500*					
Jul		8,000	8,000	6,500	5,000	4,000
Aug		4,000	4,000	4,000	3,500	3,000
Sep	3,000					
Oct		4,000	4,000	4,000	4,000	3,000
Nov-Dec		4,500	4,500	4,500	4,500	3,500

\* Increase to 6,000 if the Dec BRl is greater than 800 TAF

[5] Minimum 3-day running average of daily Delta outflow of 7,100 cfs OR: either the daily average or 14-day running average EC at Collinsville is less than 2.64 mmhos/cm (This standard for March may be relaxed if the Feb BRl is less than 500 TAF. The standard does not apply in May and June if the May estimate of the SRI IS < 8.1 MAF at the 90% exceedence level in which case a minimum 14-day running average flow of 4,000 cfs is required.) For additional Delta outflow objectives, see TABLE A.

[6] February starting salinity: If Jan BRl > 900 TAF, then the daily or 14-day running average EC @ Collinsville must be ≤ 2.64 mmhos/cm for at least one day between Feb 1-14. If Jan BRl is between 650 TAF and 900 TAF, then the CalFed Op's group will determine if this requirement must be met.

[7] Rio Vista minimum monthly average flow rate in cfs (the 7-day running average shall not be less than 1,000 below the monthly objective).

Year Type	All	W	AN	BN	D	C
Sep	3,000					
Oct		4,000	4,000	4,000	4,000	3,000
Nov-Dec		4,500	4,500	4,500	4,500	3,500

[8] BASE Vernalis minimum monthly average flow rate in cfs (the 7-day running average shall not be less than 20% below the objective). Take the higher objective if X2 is required to be west of Chipps Island.

Year Type	All	W	AN	BN	D	C
Feb-Apr14 and May16-Jun		2,130 or 3,420	2,130 or 3,420	1,420 or 2,280	1,420 or 2,280	710 or 1,140

[9] PULSE Vernalis minimum monthly average flow rate in cfs. Take the higher objective if X2 is required to be west of Chipps Island.

Year Type	All	W	AN	BN	D	C
Apr15 - May15		7,330 or 8,620	5,730 or 7,020	4,620 or 5,480	4,020 or 4,880	3,110 or 3,540
Oct	1,000*					

\* Up to an additional 28 TAF pulse/attraction flow to bring flows up to a monthly average of 2,000 cfs except for a critical year following a critical year. Time period based on real-time monitoring and determined by CalFed Op's group.

[10] For the Nov-Jan period, Delta Cross Channel gates may be closed for up to a total of 45 days.

[11] For the May 21-June 15 period, close Delta Cross Channel gates for a total of 14 days per CALFED Op's group. During the period the Delta cross channel gates may close 4 consecutive days each week, excluding weekends.

[12] Minimum # of days that the mean daily chlondes ≤ 150 mg/l must be provided in intervals of not less than 2 weeks duration. Standard applies at Contra Costa Canal Intake or Antioch Water Works Intake.

Year Type	W	AN	BN	D	C
# Days	240	190	175	165	155

(Footnotes continued on next page)

[13] The maximum 14-day running average of mean daily EC (mmhos/cm) depends on water year type.

Year Type	WESTERN DELTA				INTERIOR DELTA			
	Sac River @ Emmaton		SJR @ Jersey Point		Mokelumne R @ Terminous		SJR @ San Andreas	
	0.45 EC from April 1 to date shown	EC value from date shown to Aug 15 *	0.45 EC from April 1 to date shown	EC value from date shown to Aug 15 *	0.45 EC from April 1 to date shown	EC value from date shown to Aug 15 *	0.45 EC from April 1 to date shown	EC value from date shown to Aug 15 *
W	Aug 15		Aug 15		Aug 15		Aug 15	
AN	Jul 1	0.63	Aug 15		Aug 15		Aug 15	
BN	Jun 20	1.14	Jun 20	0.74	Aug 15		Aug 15	
D	Jun 15	1.67	Jun 15	1.35	Aug 15		Jun 25	0.58
C		2.78		2.20		0.54		0.87

\* When no date is shown, EC limit continues from April 1.

[14] As per D-1641, for San Joaquin River at Vernalis; however, the April through August maximum 30-day running average EC for San Joaquin River at Brandt Bridge, Old River near Middle River, and Old River at Tracy Road Bridge shall be 1.0 EC until April 1, 2005 when the value will be 0.7 EC.

[15] Compliance will be determined between Jersey Point & Prisoners Point.  
Does not apply in critical years or in May when the May 90% forecast of SRI  $\leq$  8.1 MAF.

[16] During deficiency period, the maximum monthly average mhtEC at Western Suisun Marsh stations as per SMPA is:

Month	mhtEC
Oct	19.0
Nov	16.5
Dec-Mar	15.6
Apr	14.0
May	12.5

[17] In November, maximum monthly average mhtEC = 16.5 for Western Marsh stations and maximum monthly average mhtEC = 15.5 for Eastern Marsh stations in all periods types.

**TABLE A**

Number of Days When Max. Daily Average Electrical Conductivity of 2.64 mmhos/cm Must Be Maintained. (This can also be met with a maximum 14-day running average EC of 2.64 mmhos/cm, or 3-day running average Delta outflows of 11,400 cfs and 29,200 cfs, respectively.) Port Chicago Standard is triggered only when the 14-day average EC for the last day of the previous month is 2.64 mmhos/cm or less. PMI is previous month's 8RI. If salinity/flow objectives are met for a greater number of days than required for any month, the excess days shall be applied towards the following month's requirement. The number of day's for values of the PMI between those specified below shall be determined by linear interpolation.

PMI (TAF)	Chipps Island (Chipps Island Station D10)				
	FEB	MAR	APR	MAY	JUN
$\leq$ 500	0	0	0	0	0
750	0	0	0	0	0
1000	28*	12	2	0	0
1250	28	31	6	0	0
1500	28	31	13	0	0
1750	28	31	20	0	0
2000	28	31	25	1	0
2250	28	31	27	3	0
2500	28	31	29	11	1
2750	28	31	29	20	2
3000	28	31	30	27	4
3250	28	31	30	29	8
3500	28	31	30	30	13
3750	28	31	30	31	18
4000	28	31	30	31	23
4250	28	31	30	31	25
4500	28	31	30	31	27
4750	28	31	30	31	28
5000	28	31	30	31	29
5250	28	31	30	31	29
$\geq$ 5500	28	31	30	31	30

\*When 800 TAF < PMI < 1000 TAF, the number of days is determined by linear interpolation between 0 and 28 days.

PMI (TAF)	Port Chicago (continuous recorder at Port Chicago)				
	FEB	MAR	APR	MAY	JUN
0	0	0	0	0	0
250	1	0	0	0	0
500	4	1	0	0	0
750	8	2	0	0	0
1000	12	4	0	0	0
1250	15	6	1	0	0
1500	18	9	1	0	0
1750	20	12	2	0	0
2000	21	15	4	0	0
2250	22	17	5	1	0
2500	23	19	8	1	0
2750	24	21	10	2	0
3000	25	23	12	4	0
3250	25	24	14	6	0
3500	25	25	16	9	0
3750	26	26	18	12	0
4000	26	27	20	15	0
4250	26	27	21	18	1
4500	26	28	23	21	2
4750	27	28	24	23	3
5000	27	28	25	25	4
5250	27	29	25	26	6
5500	27	29	26	28	9
5750	27	29	27	28	13
6000	27	29	27	29	16
6250	27	30	27	29	19
6500	27	30	28	30	22
6750	27	30	28	30	24
7000	27	30	28	30	26
7250	27	30	28	30	27
7500	27	30	29	30	28
7750	27	30	29	31	28
8000	27	30	29	31	29
8250	28	30	29	31	29
8500	28	30	29	31	29
8750	28	30	29	31	30
9000	28	30	29	31	30
9250	28	30	29	31	30
9500	28	31	29	31	30
9750	28	31	29	31	30
10000	28	31	30	31	30
$>$ 10000	28	31	30	31	30

Footnotes for Figure 1: Summary Bay Delta Standards

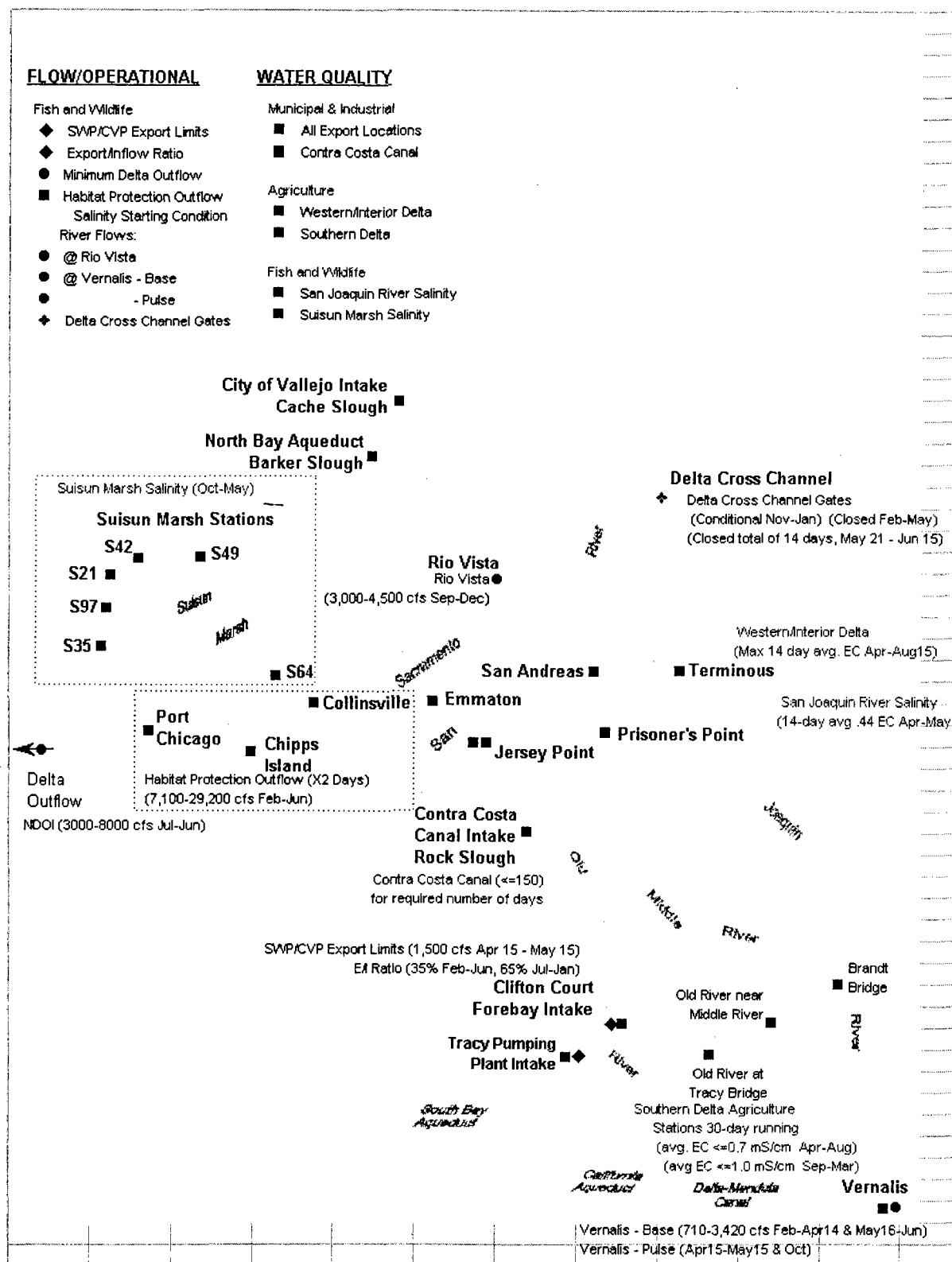


Figure 1 CVP/SWP Delta Map

### **Joint Point of Diversion**

D-1641 granted Reclamation and DWR the ability to use/exchange each Project's diversion capacity capabilities to enhance the beneficial uses of both Projects. The SWRCB conditioned the use of joint point of diversion (JPOD) capabilities based on a staged implementation and conditional requirements for each stage of implementation. The stages of JPOD in D-1641 are:

- Stage 1 – for water service to Cross Valley Canal contractors and Musco Olive, and to recover export reductions taken to benefit fish.
- Stage 2 – for any purpose authorized under the current project water right permits.
- Stage 3 – for any purpose authorized up to the physical capacity of the diversion facilities.

Each stage of JPOD has regulatory terms and conditions which must be satisfied in order to implement JPOD.

All stages require a response plan to ensure water levels in the southern Delta will not be lowered to the injury of water users in the southern Delta (Water Level Response Plan). All stages require a response plan to ensure the water quality in the southern and central Delta will not be significantly degraded through operations of the JPOD to the injury of water users in the southern and central Delta.

All JPOD diversion under excess conditions in the Delta is junior to Contra Costa Water District (CCWD) water right permits for the Los Vaqueros Project, and must have an X2 location west of certain compliance locations consistent with the Service's 1993 Los Vaqueros Biological Opinion (BO) for delta smelt (Service 1993b).

Stage 2 has an additional requirement to complete an operations plan that will protect fish and wildlife and other legal users of water. This is commonly known as the Fisheries Response Plan. Stage 3 has an additional requirement to protect water levels in the southern Delta under the operational conditions of the permanent South Delta Barrier program, along with an updated companion Fisheries Response Plan.

Reclamation and DWR intend to apply all response plan criteria consistently for JPOD uses as well as water transfer uses.

In general, JPOD capabilities will be used to accomplish four basic Project objectives:

- When wintertime excess pumping capacity becomes available during Delta excess conditions and total Project San Luis storage is not projected to fill before the spring pulse flow period, the project with the deficit in San Luis storage may elect to use JPOD capabilities. Concurrently, under the CALFED ROD, JPOD may be used to create additional water supplies for the EWA or reduce debt for previous EWA actions.
- When summertime pumping capacity is available at Banks Pumping Plant and CVP reservoir conditions can support additional releases, the CVP may elect to use JPOD capabilities to enhance annual CVP south of Delta water supplies.

- When summertime pumping capacity is available at Banks or Tracy Pumping Plant to facilitate water transfers, JPOD may be used to further facilitate the water transfer.
- During certain coordinated Project operation scenarios for fishery entrainment management, JPOD may be used to maximize Project exports at the facility with the least fishery entrainment impact while minimizing export at the facility with the most fishery entrainment impact.

### **Adaptive Management**

Reclamation and DWR work closely with the Service, the National Marine Fisheries Service (NOAA Fisheries), and the California Department of Fish and Game (DFG) to coordinate Project operations with fishery needs. This coordination is facilitated through several forums discussed below.

### **CALFED Ops Group**

The CALFED Ops Group consists of the Project Agencies, the Service, NOAA Fisheries, and DFG (collectively referred to as the Management Agencies), SWRCB staff, and the Federal Environmental Protection Agency (EPA). The CALFED Ops Group generally meets eleven times a year in a public setting to discuss the operation of the CVP and SWP, as well as implementation of the CVPIA and coordination with endangered species protection. The CALFED Ops Group held its first public meeting in January 1995, and during the next 6 years the group developed and refined its process. The CALFED Ops Group has been recognized within D-1641, and elsewhere, as a forum for consultation on decisions to exercise certain flexibility that has been incorporated into the Delta standards for protection of beneficial uses (e.g., Export/Inflow (E/I) ratios, and some DCC Closures). Several teams were established through the Ops Group process. These teams are described below:

**Operations and Fishery Forum:** The Operations and Fishery Forum (OFF) was established as a stakeholder-driven process to disseminate information regarding recommendations and decisions about the operations of the CVP and SWP. OFF members are considered the contact person for their respective agency or interest group when information regarding take of listed species, or other factors and urgent issues need to be addressed by the CALFED Ops Group. Alternatively, the OFF may be directed by the CALFED Ops Group to develop recommendations on operational responses for issues of concern raised by member agencies.

**Data Assessment Team (DAT):** The DAT consists of technical staff members from the Project and Management agencies, as well as stakeholders. The DAT meets frequently<sup>2</sup> during the fall, winter, and spring to review and interpret data relating to fish movement, location, and behavior. Based upon its assessment and input concerning the CVP and SWP operations from the Project Agencies, the DAT makes recommendations regarding potential changes in operations to protect fish. These recommendations are a key element to the implementation of the EWA (discussed

---

<sup>2</sup> The DAT holds weekly conference calls and may have additional discussions during other times as needed.

later).

**B2 Interagency Team (B2IT):** The B2IT was established in 1999 and consists of technical staff members from the Project and Management agencies. The B2IT meets weekly to discuss implementation of section 3406 b(2) of the CVPIA, which defines the dedication of CVP water supply for environmental purposes. It communicates with the Environmental Water Account Team (EWAT) and Water Operations Management Team (WOMT) to ensure coordination with the other operational programs or resource-related aspects of project operations.

**Environmental Water Account Team:** The EWAT consists of members from the Project and Management agencies. The EWAT is responsible for implementation and reporting of actions to acquire water for the EWA. It also coordinates with the B2IT to develop strategies that maximize benefits derived from implementation of actions under CVPIA and the EWA.

### **Fisheries Technical Teams**

Several fisheries specific teams have been established to provide guidance on resource management issues. These teams include:

**The Sacramento River Temperature Task Group (SRTTG):** The SRTTG is a multiagency group formed pursuant to SWRCB Water Rights Orders 90-5 and 91-1 (Reclamation 2004), to assist with improving and stabilizing Chinook population in the Sacramento River. Annually, Reclamation develops temperature operation plans for the Shasta and Trinity divisions of the CVP. These plans consider impacts on winter-run and other races of Chinook salmon, and associated project operations. The SRTTG meets initially in the spring to discuss biological and operational information, objectives, and alternative operations plans for temperature control. Once the SRTTG has recommended an operation plan for temperature control, Reclamation then submits a report to the SWRCB, generally on or before June 1 each year.

After implementation of the operation plan, the SRTTG may perform additional studies and holds meetings as needed to develop revisions based on updated biological data, reservoir temperature profiles and operations data. Updated plans may be needed for summer operations protecting winter-run, or in fall for fall-run spawning season. If there are any changes in the plan, Reclamation submits a supplemental report.

**The Salmon Decision Process:** The Salmon Decision Process is used by the fishery agencies and project operators to facilitate the often complex coordination issues surrounding DCC gate operations and the purposes of fishery protection closures, Delta water quality, and/or export reductions. Inputs such as fish lifestage and size development, current hydrologic events, fish indicators (such as the Knight's Landing Catch Index and Sacramento Catch Index), and salvage at the export facilities, as well as current and projected Delta water quality conditions, are used to determine potential DCC closures and/or export reductions. The coordination process has worked well during the recent fall and winter DCC operations and is expected to be used in the present or modified form in the future. See Appendix B of the biological assessment.

**Delta Smelt Working Group (Working Group):** The Working Group was established in 1995 to resolve biological and technical issues regarding delta smelt and to develop recommendations for consideration by the Service. It is generally activated when Reclamation and DWR seek consultation with Service on delta smelt or when unusually high salvage of delta smelt occurs. It can also be activated, and has been activated, to assist with the development of strategies to improve habitat conditions for delta smelt.

The Working Group will consist of representatives from the Service, DFG, DWR, EPA, Reclamation and the California Bay-Delta Authority. The Service will chair the group and a designated lead will be assigned by each agency. At a minimum, representatives must be present from the Service, DWR and Reclamation at a Working Group meeting for any recommendation to be decided upon and transmitted to the WOMT. The Working Group may meet at the request of any member of the group.

**Delta Smelt Risk Assessment Matrix:** The Working Group will employ a Delta Smelt Risk Assessment Matrix (DSRAM) to assist in formulating recommendations. This document will be a product and tool of the Working Group and will be modified by the Working Group with the approval of WOMT as new knowledge becomes available. The current DSRAM has been provided by the Working Group (see the DSRAM section for more information).

Recommendations formulated by the Working Group will be forwarded to the WOMT. The working group will not decide what actions will be taken, but will merely advise the WOMT. The working group will not supplant the DAT, but will provide an additional source of advice to the WOMT. The group may propose operations modifications that the group believes will protect delta smelt by reducing take at the export facilities or by preserving smelt habitat.

**American River Operations Work Group (AROG):** In 1996, Reclamation established an operational working group for the lower American River, known as AROG. Although open to anyone, the AROG meetings generally include representatives from several agencies and organizations with on-going concerns regarding management of the lower American River. The group includes Reclamation, Service, NOAA Fisheries, DFG, Sacramento Area Flood Control Agency (SAFCA), Water Forum, City of Sacramento, County of Sacramento, Western Area Power Administration (Western), and Save the American River Association. The AROG convenes monthly, or more frequently if needed, with the purpose of providing fishery updates and reports for Reclamation to better manage Folsom Reservoir for fish resources in the lower American River.

**San Joaquin River Technical Committee (SJRTC):** The SJRTC meets for the purposes of planning and implementing the VAMP each year and oversees two subgroups: the Biology subgroup, and the Hydrology subgroup. These two groups are charged with certain responsibilities, and must also coordinate their activities within the San Joaquin River Agreement (SJRA) Technical Committee.

**DCC Project Work Team:** The DCC Project Work Team is a multiagency group under CALFED. Its purpose is to determine and evaluate the affects of DCC gate operations on Delta

hydrodynamics, water quality, and fish migration. The work team coordinates with the DAT and OFF groups to conduct gate experiments and members may be used as a resource to estimate impacts from real time gate operations.

### **Water Operations Management Team**

To facilitate timely decision-support and decision-making at the appropriate level, a management-level team was established. The WOMT first met in 1999, and consists of management level participants from the Project and Management agencies. The WOMT meets frequently<sup>3</sup> to provide oversight and decision-making that must routinely occur within the CALFED Ops Group process. The WOMT relies heavily upon the DAT and B2IT for recommendations on fishery actions. It also uses the CALFED Ops Group to communicate with stakeholders about its decisions. Although the goal of WOMT is to achieve consensus on decisions, the agencies retain their authorized roles and responsibilities.

### **Process for Using Adaptive Management**

Decisions regarding Project operations must consider many factors that include public safety, water supply reliability, cost, as well as regulatory and environmental requirements. To facilitate such decisions, the Project and Management agencies have developed and refined a process to collect data, disseminate information, develop recommendations, and make decisions.

**A workgroup makes a recommendation for a change in Project operations.** Generally, operational adjustments to protect fish are initiated as the result of concern expressed over the interpretation of data that have been collected or as a part of an overarching strategic plan to improve habitat conditions. Examples of conditions that could signal concern include observance of large numbers of juvenile Chinook entering the Delta, high salvage of delta smelt at the export facilities, or unfavorable distribution of delta smelt throughout the Delta. Examples of strategic plans include maintaining higher releases for in-stream needs or closing the DCC gates to keep emigrating juvenile Chinook from entering the central Delta.

**The Project Agencies consider the recommendation and seek consensus with the Management Agencies.** Decisions regarding changes to the Project operations must be made quickly to be effective. To accomplish this, recommendations are vetted with the management-level staff of the Project and Management agencies. This provides for appropriate consideration of the many factors that must be taken into consideration.

**The recommendations and decisions are disseminated.** Numerous stakeholders have a keen interest in Project operations. In fact, workgroups established through the Ops Group process (DAT and OFF are two prime examples) have significant stakeholder involvement. In addition, decisions regarding the projects can have significant policy-related implications that must be

---

<sup>3</sup> As with the DAT, WOMT holds weekly meetings during the critical fish periods. In addition, it will hold impromptu meetings or conference calls to consider recommendations for changes in the operations of the CVP and SWP.

presented to the State and Federal administrations. To facilitate adequate feedback to stakeholders, Reclamation and DWR disseminate recommendations and the resulting decisions to agencies and stakeholders through the OFF and DAT.

**Annual reporting is performed to summarize when decision trees are used and results are updated.** Example: The DAT determines adult delta smelt are migrating upstream to spawn in sufficient numbers to warrant a change in pumping levels. After careful consideration of the water supply costs to the EWA and CVPIA b(2) water assets, DAT recommends a 5-day reduction in exports.

The WOMT meets and considers the recommendation of the DAT, and after careful consideration of the recommendation, WOMT agrees that EWA and CVPIA b(2) assets may be used to implement the export reduction. Reclamation and DWR then implement the export reduction as prescribed.

In addition, South Delta barrier operations will be further studied and refined by WOMT/DAT representatives, including Reclamation, DWR, DFG, NOAA Fisheries, Delta stakeholders and representatives of the delta smelt Working Group. Representatives from these groups will meet to determine how best to operate South Delta barriers in order to balance fish needs with water levels and water quality needs. Forecast modeling as well as monitoring of real-time barrier operations will be used to modify operations as needed.

## **Central Valley Project**

### **Project Management Objectives**

The CVP is the Mid-Pacific Region's largest project. Facilities are operated and maintained by local Reclamation area offices, with operations overseen by the CVOO at the Joint Operations Center in Sacramento, California. The CVOO is responsible for recommending CVP operating policy, developing annual operating plans, coordinating CVP operations with the SWP and other entities, establishing CVP-wide standards and procedures, and making day-to-day operating decisions. Figure 1-4 shows the relationship between the CVOO and Reclamation area offices in the Mid-Pacific Region.

### ***Central Valley Project Improvement Act***

On October 30, 1992, Public Law 102-575, (Reclamation Projects Authorization and Adjustment Act of 1992) was passed. Included in the law was Title 34, the CVPIA. The CVPIA amended previous authorizations of the CVP to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic water supply uses, and fish and wildlife enhancement having an equal priority with power generation. Among the changes mandated by the CVPIA are:

- Dedicating 800,000 af annually to fish, wildlife, and habitat restoration
- Authorizing water transfers outside the CVP service area
- Implementing an anadromous fish restoration program
- Creating a restoration fund financed by water and power users

- Providing for the Shasta Temperature Control Device
- Implementing fish passage measures at Red Bluff Diversion Dam
- Calling for planning to increase the CVP yield
- Mandating firm water supplies for Central Valley wildlife refuges
- Improving the Tracy Fish Collection Facility (TFCF)
- Meeting Federal trust responsibility to protect fishery resources(Trinity River)

The CVPIA is being implemented on a broad front. The Final Programmatic Environmental Impact Statement (PEIS) (Reclamation 2004) for the CVPIA analyzes projected conditions in 2022, 30 years from the CVPIA's adoption in 1992. The Final PEIS was released in October 1999 and the CVPIA ROD was signed on January 9, 2001. The BOs were issued on November 21, 2000 (Service 2000).

Operations of the CVP reflect provisions of the CVPIA, particularly sections 3406(b)(1), (b)(2), and (b)(3). On May 9, 2003, the U.S. Department of the Interior (Interior) issued its Decision on Implementation of Section 3406 (b)(2) of the CVPIA (Reclamation 2004). The B2IT provides the basis for implementing upstream and Delta actions with CVP delivery capability.

### **Water Service Contracts, Allocations and Deliveries**

#### ***Water Needs Assessment***

Water needs assessments have been performed for each CVP water contractor eligible to participate in the CVP long-term contract renewal process. Water needs assessments confirm a contractor's past beneficial use and determine future CVP water supplies needed to meet the contractor's anticipated future demands. The assessments are based on a common methodology used to determine the amount of CVP water needed to balance a contractor's water demands with available surface and groundwater supplies.

As of December 2003, most of the contractor assessments have been finalized. However, a couple of assessments remain under analysis and require either additional information from the contractor or do not fit into the assumptions incorporated into the methodology used for the rest of the CVP. The contractors are located primarily in the American River and San Felipe Divisions of the CVP. It is anticipated that all the assessments will be concluded by summer of 2004. Because of the remaining assessments, the total supply required to meet the all the demands for the CVP cannot be determined at this time.

For modeling purposes, assumptions for future conditions have been made, even though the water assessments continue. The 2020 level of development's demands include higher amounts than the 2001 level of development's demands on the American River.

#### ***Future American River Operations - Water Service Contracts and Deliveries***

Surface water deliveries from the American River are made by various water rights entities and CVP contractors. Total annual demands on the American and Sacramento Rivers are estimated to increase from about 255,850 af in 2001 to about 687,550 af in 2020, including the FRWP. Reclamation is negotiating the renewal of 13 long-term water service contracts, four Warren Act

contracts, and has a role in six infrastructure or Folsom Reservoir operations actions influencing the management of American River Division facilities and water use.

### ***Water Allocation – CVP***

In most years, the combination of carryover storage and runoff into CVP reservoirs is sufficient to provide the water to meet CVP contractors' demands. Since 1992, increasing constraints placed on operations by legislative and Act requirements have removed some of the capability and operations flexibility required to actually deliver the water to CVP contractors. Water allocations south of the Delta have been most affected by changes in operations ensuing from passage of the CVPIA and the biological opinions covering protection of the winter-run Chinook salmon and the delta smelt.

The water allocation process for CVP begins in the fall when preliminary assessments are made of the next year's water supply possibilities, given current storage conditions combined with a range of hydrologic conditions. These preliminary assessments may be refined as the water year progresses. Beginning February 1, forecasts of water year runoff are prepared using precipitation to date, snow water content accumulation, and runoff to date. All of CVP's Sacramento River water rights contracts and San Joaquin Exchange contracts require that contractors be informed no later than February 15 of any possible deficiency in their supplies. In recent years, February 15th has been the target date for the first announcement of all CVP contractors' forecasted water allocations for the upcoming contract year.

The NOAA Fisheries Biological Opinion (Reclamation 2004) requires Reclamation to use a conservative (at least 90 percent probability of exceedance) forecast as the basis of water allocations. Furthermore, NOAA Fisheries reviews the operations plans devised to support the initial water allocation, and any subsequent updates to them, for sufficiency with respect to the criteria for Sacramento River temperature control.

Forecasts of runoff and operations plans are updated at least monthly between February and May. Water allocations may or may not change as the year unfolds. Because a conservative forecast of runoff is used, it is quite likely that forecasted water supply will increase as the year progresses. While this may result in increased allocations, it also means that knowledge of the final allocation of water may be delayed until April, May, or June. This adds to the uncertainty facing Agricultural contractors who need reliable forecasts of available supply as early as possible to assist in decision-making for farm management.

### ***CVP M&I Water Shortage Policy***

The CVP has 253 water service contracts (including Sacramento River Settlement Contracts). These water service contracts have had varying water shortage provisions (e.g., in some contracts, M&I and agricultural uses have shared shortages equally; in most of the larger M&I contracts, agricultural water has been shorted 25 percent of its contract entitlement before M&I water was shorted, and then both shared shortages equally). Since 1991, Reclamation has been attempting to develop an M&I Water shortage policy applicable to as many CVP M&I contractors as appropriate.

For a contractor to receive the M&I minimum shortage allocation by means of the proposed policy, its water service contract must reference the proposed policy. For various reasons, Reclamation expects the proposed policy will not be referenced in contracts for the (1) Friant Division, (2) New Melones interim supply, (3) Hidden and Buchanan Units, (4) Cross Valley contractors, (5) Sugar Pine Units (subjects of title transfer legislation), (6) San Joaquin settlement contractors, and (7) Sacramento River settlement contractors. Any separate shortage-related contractual provisions will prevail.

The proposed policy provides a minimum shortage allocation for M&I water supplies of 75 percent of a contractor's historical use (i.e., the last 3 years of water deliveries unconstrained by the availability of CVP water). Historical use can be adjusted for growth, extraordinary water conservation measures, and use of non-CVP water as those terms are defined in the proposed policy. Before the M&I water allocation is reduced, the irrigation water allocation would be reduced below 75 percent of contract entitlement.

The proposed policy also provides that when the allocation of irrigation water is reduced below 25 percent of contract entitlement, Reclamation will reassess the availability of CVP water and CVP water demand; however, due to limited water supplies during these times, M&I water allocation may be reduced below 75 percent of adjusted historical use. Shortages for South of Delta and North of Delta irrigation allocations and M&I allocations are the same.

The proposed policy provides that Reclamation will deliver CVP water to all M&I contractors at not less than a public health and safety level if CVP water is available, if an emergency situation exists, (taking into consideration water supplies available to the M&I contractors from other sources), and in recognition that the M&I allocation may, nevertheless, fall to 50 percent when the irrigation allocation drops below 25 percent due to limited CVP supplies. It should be noted the minimum shortage allocation of 75 percent, as proposed in the September 11, 2001 draft (Reclamation 2004) (which was made available for public review and comment) would apply only to that portion of CVP water identified as of September 30, 1994, as shown on Schedule A-12 of the 1996 M&I Water Rates book, (Reclamation 2004) and for those contract quantities specified in section 206 of Public Law 101-514. However, under the proposed policy a contractor may request an M&I minimum shortage allocation for post-1994 identified water that is transferred or assigned, converted, provided significant impacts upon irrigation supplies, or upon irrigation and M&I supplies, respectively, are mitigated.

Due to the development of policy alternatives generated by Reclamation after consideration of public comment, that portion of CVP water to which the minimum shortage allocation would apply could change prior to policy finalization. Prior to such finalization, Reclamation will meet the requirements of the National Environmental Policy Act (NEPA) and the Act.

Ag 100% to 75% then M&I is at 100%	
Ag 70%	M&I is 95%
Ag 65%	M&I 90%
Ag 60%	M&I 85%
Ag 55%	M&I 80%

Ag 50% to 25%      M&I 75%

Dry and critical years has a modeling assumption

Ag 20%	M&I 70%
Ag 15%	M&I 65%
Ag 10%	M&I 60%
Ag 5%	M&I 55%
Ag 0	M&I 50%

### **Trinity River Division Operations**

The Trinity River Division, completed in 1964, includes facilities to store and regulate water in the Trinity River, as well as facilities to divert water to the Sacramento River Basin. Trinity Dam is located on the Trinity River and regulates the flow from a drainage area of approximately 720 square miles. The dam was completed in 1962, forming Trinity Lake, which has a maximum storage capacity of approximately 2.4 million acre-feet (maf).

The mean annual inflow to Trinity Lake from the Trinity River is about 1.2 maf per year. Historically, an average of about two-thirds of the annual inflow has been diverted to the Sacramento River Basin (1991-2003). Trinity Lake stores water for release to the Trinity River and for diversion to the Sacramento River via Lewiston Reservoir, Carr Tunnel, Whiskeytown Reservoir, and Spring Creek Tunnel where it commingles in Keswick Reservoir with Sacramento River water released from both the Shasta Dam and Spring Creek Debris Dam (SCDD).

### **Safety of Dams at Trinity Reservoir**

Periodically, increased water releases are made from Trinity Dam consistent with Reclamation safety of dams criteria intended to prevent overtopping of Trinity Dam. Although flood control is not an authorized purpose of the Trinity River Division, flood control benefits are provided through normal operations.

Trinity Dam has limited release capacity below the spillway crest elevation. Studies completed by the U.S. Army Corps of Engineers (Corps) in 1974 and Reclamation in 1975 (Reclamation 2004) showed the spillway and outlet works at Trinity Dam are not sufficient to safely pass the anticipated design flood inflow. Therefore, Reclamation implemented safety of dams criteria stipulating flood season release and storage criteria at Trinity Dam to reduce the potential for overtopping during large flood events. The safety of dams criteria attempt to prevent storage from exceeding 2.1 maf from November through March. The safety of dams criteria begin to prescribe reservoir releases when storage in Trinity Dam is forecast to exceed 2.0 maf during November through March, see appendix C for the historic times safety of dams releases have been made.

The safety of dams release criteria specifies that Carr Powerplant capacity should be used as a first preference destination for safety of dams releases made at Trinity Dam. Trinity River releases are made as a second preference destination. During significant Northern California

high water flood events, the Sacramento River water stages are also at concern levels. Under such high water conditions, the water that would otherwise move through Carr Powerplant is routed to the Trinity River. Total river release is limited to 6,000 cfs below Lewiston Dam (under safety of dams criteria) due to local high water concerns and local bridge flow capacities; until local inflows to Lewiston Lake and Trinity Dam spillway flows exceed 6,000 cfs; and also the Carr Powerplant discharge.

### **Fish and Wildlife Requirements on Trinity River**

Based on the December 19, 2000, Trinity ROD(Reclamation 2004), 368,600 to 815,000 af is allocated annually for Trinity River flows. Due to ongoing litigation on the Trinity ROD, the Federal District Court for the Eastern District of California issued a December 10, 2002, Order (Reclamation 2004) that directed the CVP to release 368,600 af during critical Trinity River inflow years and 452,000 af during all other conditions. This amount is scheduled in coordination with the Service to best meet habitat, temperature, and sediment transport objectives in the Trinity Basin.

Temperature objectives for the Trinity River are set forth in SWRCB WR 90-5. These vary by reach and by season. Between Lewiston Dam and Douglas City Bridge, the daily average temperature should not exceed 60 degrees Fahrenheit (°F) (16 degrees Celsius (°C)) from July 1 to September 14 and 56°F (13°C ) from September 15 to October 1. From October 1 to December 31, the daily average temperature should not exceed 56°F (13°C ) between Lewiston Dam and the confluence of the North Fork Trinity River. Reclamation consults with Service in establishing a schedule of releases from Lewiston Dam that can best achieve these objectives.

For the purpose of determining the Trinity water year type, forecasts using a 50 percent exceedance will be used. Trinity River flow regimes will be planned and adjusted, if necessary, to be consistent with forecasts prepared during the April 1 through May period. There will be no make-up/or increases for flows forgone if the water year type changes up or down from an earlier 50 percent forecast. In the modeling, actual historic Trinity inflows were used rather than a forecast. There is a temperature curtain in Lewiston Reservoir.

### **Transbasin Exports**

Export of Trinity water to the Sacramento Basin provides water supply and hydroelectric power generation for the CVP and assists in water temperature control in the Trinity River and upper Sacramento River. The amounts and timing of the Trinity exports are determined by subtracting Trinity River scheduled flow and targeted carryover storage from the forecasted Trinity water supply.

The seasonal timing of Trinity exports is a result of determining how to make best use of a limited volume of Trinity export (in concert with releases from Shasta) to help conserve cold water pools and meet temperature objectives on the upper Sacramento and Trinity rivers, as well as power production economics. A key consideration in the export timing determination is the thermal degradation that occurs in Whiskeytown Lake due to the long residence time of

transbasin exports in the lake.

To minimize the thermal degradation effects, transbasin export patterns are typically scheduled by an operator to provide an approximate 120,000 af volume to occur in late spring to create a thermal connection to the Spring Creek Powerhouse before larger transbasin volumes are scheduled to occur during the hot summer months. Typically, to avoid warming and function most efficiently for temperature control, the water flowing from the Trinity Basin through Whiskeytown must be sustained at fairly high rates. When the total volume of Trinity water available for export is limited, that may, in turn, compress the time period for which effective temperature control releases can be made from Whiskeytown Lake.

To increase CVP water supply, export volumes from Trinity are made in coordination with the operation of other CVP water supply reservoirs generally based on reservoir refill potential and CVP Delta export water demand. Other important considerations affecting the timing of Trinity exports are based on the utility of power generation and allowances for normal maintenance of the diversion works and generation facilities.

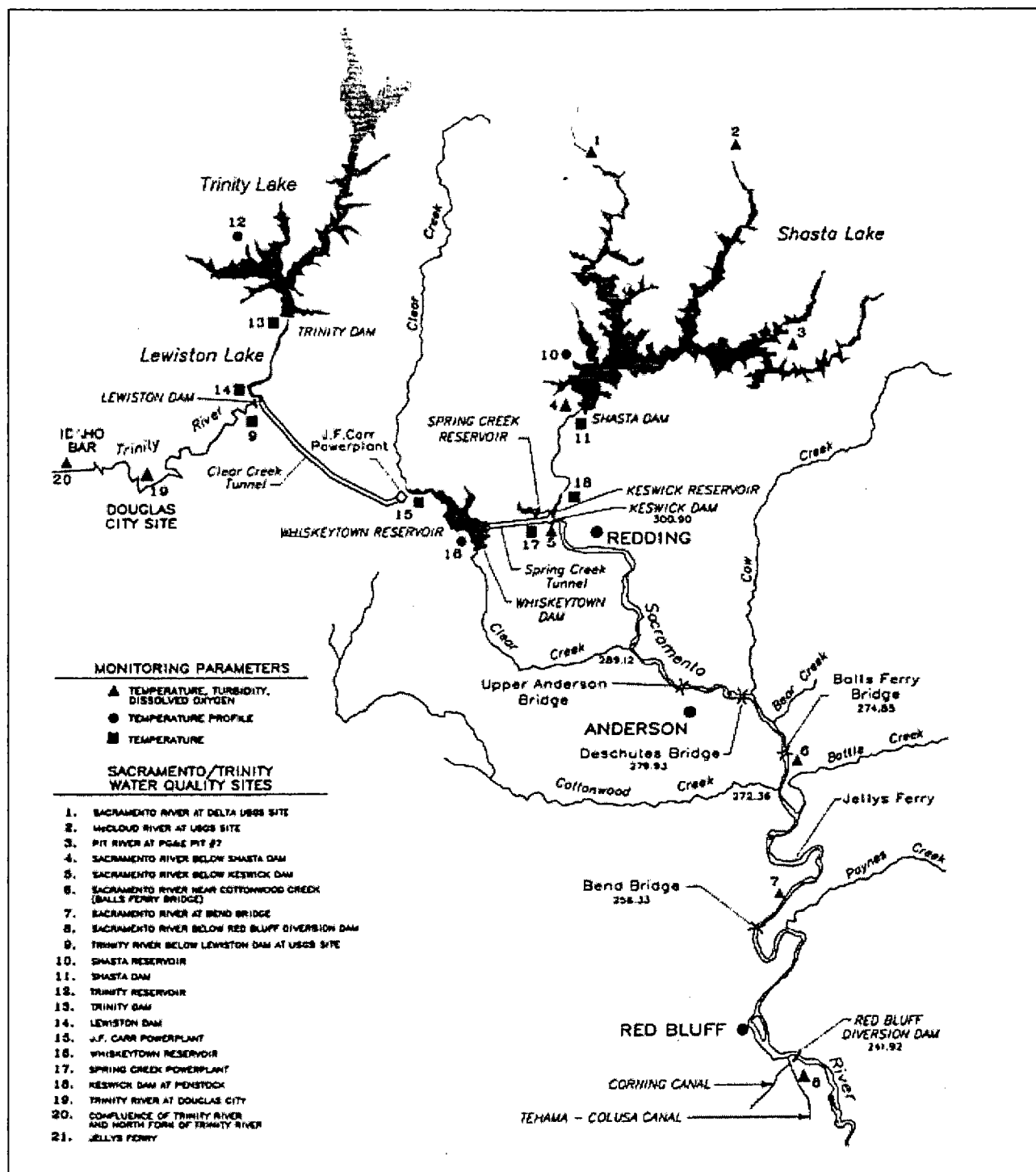


Figure 2 Sacramento-Trinity Water Quality Network (with river miles)

Power production, as a result of cross-basin diversion of Trinity River water through Trinity Division powerplants, is approximately three times greater than power production at Shasta Dam for an equivalent amount of water released. Trinity Lake historically reached its greatest storage level at the end of May. With the present pattern of prescribed Trinity releases, maximum storage may occur by the end of April or in early May.

Reclamation maintains at least 600,000 af in Trinity Reservoir, until the 10 to 15 percent of the years when Shasta Reservoir is also drawn down. Reclamation will discuss end of water year carryover on a case-by-case basis in dry and critically dry water year types with the Service and NOAA Fisheries.

### **Whiskeytown Reservoir Operations**

Since 1964, a portion of the flow from the Trinity River Basin has been exported to the Sacramento River Basin through the CVP facilities. Water is diverted from the Trinity River at Lewiston Dam via the Clear Creek Tunnel and passes through the Judge Francis Carr Powerhouse as it is discharged into Whiskeytown Lake on Clear Creek. From Whiskeytown Lake, water is released through the Spring Creek Power Conduit to the Spring Creek Powerplant and into Keswick Reservoir. All of the water diverted from the Trinity River, plus a portion of Clear Creek flows, is diverted through the Spring Creek Power Conduit into Keswick Reservoir.

Spring Creek also flows into the Sacramento River and enters at Keswick Reservoir. Flows on Spring Creek are partially regulated by the SCDD. Historically (1964-1992), an average annual quantity of 1,269,000 af of water has been diverted from Whiskeytown Lake to Keswick Reservoir. This annual quantity is approximately 17 percent of the flow measured in the Sacramento River at Keswick.

Whiskeytown is normally operated to (1) regulate inflows for power generation and recreation; (2) support upper Sacramento River temperature objectives; and (3) provide for releases to Clear Creek consistent with the CVPIA AFRP objectives. Although it stores up to 241,000 af, this storage is not normally used as a source of water supply. There is a temperature curtain in Whiskeytown Reservoir.

### **Spillway flows below Whiskeytown Lake**

Whiskeytown Lake is drawn down approximately 35,000 af per year of storage space during November through April to regulate flows for power generation. Heavy rainfall events occasionally result in spillway discharges to Clear Creek, as shown in Table 1 below.

**Table 1 Days of Spilling below Whiskeytown and 40-30-30 Index from Water Year 1978 to 2002**

<b>Water Year</b>	<b>Days of Spilling</b>	<b>40-30-30 Index</b>
1978	5	AN
1979	0	BN
1980	0	AN
1981	0	D
1982	63	W

**Table 1 Days of Spilling below Whiskeytown and 40-30-30 Index from Water Year 1978 to 2002**

Water Year	Days of Spilling	40-30-30 Index
1983	81	W
1984	0	W
1985	0	D
1986	17	W
1987	0	D
1988	0	C
1989	0	D
1990	8	C
1991	0	C
1992	0	C
1993	10	AN
1994	0	C
1995	14	W
1996	0	W
1997	5	W
1998	8	W
1999	0	W
2000	0	AN
2001	0	D
2002	0	D

Operations at Whiskeytown Lake during flood conditions are complicated by its operational relationship with the Trinity River, Sacramento River, and Clear Creek. On occasion, imports of Trinity River water to Whiskeytown Reservoir may be suspended to avoid aggravating high flow conditions in the Sacramento Basin.

### **Fish and Wildlife Requirements on Clear Creek**

Water rights permits issued by the SWRCB for diversions from Trinity River and Clear Creek specify minimum downstream releases from Lewiston and Whiskeytown Dams, respectively. Two agreements govern releases from Whiskeytown Lake:

- A 1960 Memorandum of Agreement (MOA) with the DFG (Reclamation 2004) established minimum flows to be released to Clear Creek at Whiskeytown Dam.
- A 1963 release schedule from Whiskeytown Dam (Reclamation 2004) was developed and implemented, but never finalized. Although the release schedule was never formalized, Reclamation has operated according to the proposed schedule since May 1963.

**Table 2 Minimum flows at Whiskeytown Dam from 1960 MOA with the DFG**

Period	Minimum flow (cfs)
January 1 - February 28(29)	50
March 1 - May 31	30
June 1 - September 30	0
October 1 - October 15	10
October 16 - October 31	30
November 1 - December 31	100
1963 FWS Proposed Normal year flow (cfs)	

Period	Minimum flow (cfs)
January 1 - October 31	50
November 1 - December 31	100
1963 FWS Proposed Critical year flow (cfs)	
January 1 - October 31	30
November 1 - December 31	70

### Spring Creek Debris Dam Operations

The SCDD is a feature of the Trinity Division of the CVP. It was constructed to regulate runoff containing debris and acid mine drainage from Spring Creek, a tributary to the Sacramento River that enters Keswick Reservoir. The SCDD can store approximately 5,800 af of water. Operation of SCDD and Shasta Dam has allowed some control of the toxic wastes with dilution criteria. In January 1980, Reclamation, the DFG, and the SWRCB executed a Memorandum of Understanding (MOU) (Reclamation 2004) to implement actions that protect the Sacramento River system from heavy metal pollution from Spring Creek and adjacent watersheds.

The MOU identifies agency actions and responsibilities, and establishes release criteria based on allowable concentrations of total copper and zinc in the Sacramento River below Keswick Dam.

The MOU states that Reclamation agrees to operate to dilute releases from SCDD (according to these criteria and schedules provided) and that such operation will not cause flood control parameters on the Sacramento River to be exceeded and will not unreasonably interfere with other project requirements as determined by Reclamation. The MOU also specifies a minimum schedule for monitoring copper and zinc concentrations at SCDD and in the Sacramento River below Keswick Dam. Reclamation has primary responsibility for the monitoring; however, the DFG and the RWQCB also collect and analyze samples on an as-needed basis. Due to more extensive monitoring, improved sampling and analyses techniques, and continuing cleanup efforts in the Spring Creek drainage basin, Reclamation now operates SCDD targeting the more stringent WQCP criteria in addition to the MOU goals. Instead of the total copper and total zinc criteria contained in the MOU, Reclamation operates SCDD releases and Keswick dilution flows to not exceed the Basin Plan standards of 0.0056 mg/L dissolved copper and 0.016 mg/L dissolved zinc. Release rates are estimated from a mass balance calculation of the copper and zinc in the debris dam release and in the river.

In order to minimize the build-up of metal concentrations in the Spring Creek arm of Keswick Reservoir, releases from the debris dam are coordinated with releases from the Spring Creek Powerplant to keep the Spring Creek arm of Keswick Reservoir in circulation with the main water body of Keswick Lake.

The operation of SCDD is complicated during major heavy rainfall events. SCDD reservoir can fill to uncontrolled spill elevations in a relatively short time period, anywhere from days to weeks. Uncontrolled spills at SCDD can occur during flood control events in the upper Sacramento River and also during non-flood control rainfall events. During flood control events, Keswick releases may be reduced to meet flood control objectives at Bend Bridge when storage and inflow at Spring Creek Reservoir are high.

Because SC DD releases are maintained as a dilution ratio of Keswick releases to maintain the required dilution of copper and zinc, uncontrolled spills can and have occurred from Spring Creek Debris Dam. In this operational situation, high metal concentration loads during heavy rainfall are usually limited to areas immediately downstream of Keswick Dam because of the high runoff entering the Sacramento River adding dilution flow. In the operational situation when Keswick releases are increased for flood control purposes, SCDD releases are also increased in an effort to reduce spill potential.

In the operational situation when heavy rainfall events will fill SCDD and Shasta Reservoir will not reach flood control conditions, increased releases from CVP storage may be required to maintain desired dilution ratios for metal concentrations. Reclamation has voluntarily released additional water from CVP storage to maintain release ratios for toxic metals below Keswick Dam. Reclamation has typically attempted to meet the Basin Plan standards but these releases have no established criteria and are dealt with on a case-by-case basis. Since water released for dilution of toxic spills is likely to be in excess of other CVP requirements, such releases increase the risk of a loss of water for other beneficial purposes.

### **Shasta Division and Sacramento River Division**

The CVP's Shasta Division includes facilities that conserve water in the Sacramento River for (1) flood control, (2) navigation maintenance, (3) agricultural water supplies, (4) M&I water supplies (5) hydroelectric power generation, (6) conservation of fish in the Sacramento River, and (7) protection of the Delta from intrusion of saline ocean water. The Shasta Division includes Shasta Dam, Lake, and Powerplant; Keswick Dam, Reservoir, and Powerplant, and the Shasta Temperature Control Device.

The Sacramento River Division was authorized after completion of the Shasta Division. It includes facilities for the diversion and conveyance of water to CVP contractors on the west side of the Sacramento River. The division includes the Sacramento Canals Unit, which was authorized in 1950 and consists of the Red Bluff Diversion Dam (RBDD), the Corning Pumping Plant, and the Corning and Tehama-Colusa Canals.

The unit was authorized to supply irrigation water to over 200,000 acres of land in the Sacramento Valley, principally in Tehama, Glenn, Colusa, and Yolo counties. Black Butte Dam, which is operated by the Corps, also provides supplemental water to the Tehama-Colusa Canals as it crosses Stony Creek. The operations of the Shasta and Sacramento River divisions are presented together because of their operational inter-relationships.

Shasta Dam is located on the Sacramento River just below the confluence of the Sacramento, McCloud, and Pit Rivers. The dam regulates the flow from a drainage area of approximately 6,649 square miles. Shasta Dam was completed in 1945, forming Shasta Lake, which has a maximum storage capacity of 4,552,000 af. Water in Shasta Lake is released through or around the Shasta Powerplant to the Sacramento River where it is re-regulated downstream by Keswick Dam. A small amount of water is diverted directly from Shasta Lake for M&I uses by local

communities.

Keswick Reservoir was formed by the completion of Keswick Dam in 1950. It has a capacity of approximately 23,800 af and serves as an afterbay for releases from Shasta Dam and for discharges from the Spring Creek Powerplant. All releases from Keswick Reservoir are made to the Sacramento River at Keswick Dam. The dam has a fish trapping facility that operates in conjunction with the Coleman National Fish Hatchery on Battle Creek. During the construction of Shasta Dam, the Toyon Pipeline was constructed to supply water from the Sacramento River to the camp used to house the workers at Toyon. The pipeline remains in use today, supplying M&I water to small communities in the area.

### **Flood Control**

Flood control objectives for Shasta Lake require that releases be restricted to quantities that will not cause downstream flows or stages to exceed specified levels. These include a flow of 79,000 cfs at the tailwater of Keswick Dam, and a stage of 39.2 feet in the Sacramento River at Bend Bridge gauging station, which corresponds to a flow of approximately 100,000 cfs. Flood control operations are based on regulating criteria developed by the Corps pursuant to the provisions of the Flood Control Act of 1944. Maximum flood space reservation is 1.3 maf, with variable storage space requirements based on an inflow parameter.

Flood control operation at Shasta Lake requires the forecasting of runoff conditions into Shasta Lake, as well as runoff conditions of unregulated creek systems downstream from Keswick Dam, as far in advance as possible. A critical element of upper Sacramento River flood operations is the local runoff entering the Sacramento River between Keswick Dam and Bend Bridge. The unregulated creeks (major creek systems are Cottonwood Creek, Cow Creek, and Battle Creek) in this reach of the Sacramento River can be very sensitive to a large rainfall event and produce large rates of runoff into the Sacramento River in short time periods. During large rainfall and flooding events, the local runoff between Keswick Dam and Bend Bridge can exceed 100,000 cfs.

The travel time required for release changes at Keswick Dam to affect Bend Bridge flows is approximately 8 to 10 hours. If the total flow at Bend Bridge is projected to exceed 100,000 cfs, the release from Keswick Dam is decreased to maintain Bend Bridge flow below 100,000 cfs. As the flow at Bend Bridge is projected to recede, the Keswick Dam release is increased to evacuate water stored in the flood control space at Shasta Lake. Changes to Keswick Dam releases are scheduled to minimize rapid fluctuations in the flow at Bend Bridge.

The flood control criteria for Keswick releases specify releases should not be increased more than 15,000 cfs or decreased more than 4,000 cfs in any 2-hour period. The restriction on the rate of decrease is intended to prevent sloughing of saturated downstream channel embankments caused by rapid reductions in river stage. In rare instances, the rate of decrease may have to be accelerated to avoid exceeding critical flood stages downstream.

### Fish and Wildlife Requirements in the Sacramento River

Reclamation operates the Shasta, Sacramento River, and Trinity River divisions of the CVP to meet (to the extent possible) the provisions of SWRCB Order 90-05 (Reclamation 2004) and the winter-run Chinook salmon BO (Reclamation 2004). An April 5, 1960, MOA between Reclamation and the DFG (Reclamation 2004) originally established flow objectives in the Sacramento River for the protection and preservation of fish and wildlife resources. The agreement provided for minimum releases into the natural channel of the Sacramento River at Keswick Dam for normal and critically dry years. Since October 1981, Keswick Dam has operated based on a minimum release of 3,250 cfs for normal years from September 1 through the end of February, in accordance with an agreement between Reclamation and DFG. This release schedule was included in Order 90-05, which maintains a minimum release of 3,250 cfs at Keswick Dam and RBDD from September through the end of February in all water years, except critically dry years.

**Table 3 Current minimum flow requirements and objectives (cfs) on the Sacramento River below Keswick Dam**

Water year type	MOA	WR 90-5	MOA and WR 90-5	1993 NOAA Fisheries winter-run BO
Period	Normal	Normal	Critically dry	All
January 1 - February 28(29)	2600	3250	2000	3250
March 1 - March 31	2300	2300	2300	3250
April 1 - April 30	2300	2300	2300	---*
May 1 - August 31	2300	2300	2300	---*
September 1 - September 30	3900	3250	2800	---*
October 1 - November 30	3900	3250	2800	3250
December 1 - December 31	2600	3250	2000	3250
Note: * No regulation.				

The 1960 MOA between Reclamation and the DFG provides that releases from Keswick Dam (from September 1 through December 31) are made with minimum water level fluctuation or change to protect salmon, and if when doing so, is compatible with other operations requirements. Releases from Shasta and Keswick Dams are gradually reduced in September and early October during the transition from meeting Delta export and water quality demands to operating the system for flood control and fishery concerns from October through December.

The reasonable and prudent alternative (RPA) contained in the 1993 NOAA Fisheries BO (Reclamation 2004) required a minimum flow of 3,250 cfs from October 1 through March 31. Also, as part of the Reasonable and Prudent Alternative (RPA), ramping constraints for Keswick release reductions from July 1 through March 31 are required as follows:

- Releases must be reduced between sunset and sunrise.

- When Keswick releases are 6,000 cfs or greater, decreases may not exceed 15 percent per night. Decreases also may not exceed 2.5 percent in one hour.
- For Keswick releases between 4,000 and 5,999 cfs, decreases may not exceed 200 cfs per night. Decreases also may not exceed 100 cfs per hour.
- For Keswick releases between 3,250 and 3,999 cfs, decreases may not exceed 100 cfs per night.
- Variances to these release requirements are allowed under flood control operations.

Reclamation usually attempts to reduce releases from Keswick Dam to the minimum fishery requirement by October 15 each year and to minimize changes in Keswick releases between October 15 and December 31. Releases may be increased during this period to meet unexpected downstream needs such as higher outflows in the Delta to meet water quality requirements, or to meet flood control requirements. Releases from Keswick Dam may be reduced when downstream tributary inflows increase to a level that will meet flow needs. To minimize release fluctuations, the base flow is selected with the intent of maintaining the desired target storage levels in Shasta Lake from October through December.

A recent change in agricultural water diversion practices has affected Keswick Dam release rates in the fall. This program is generally known as the Rice Straw Decomposition and Waterfowl Habitat Program. Historically, the preferred method of clearing fields of rice stubble was to systematically burn it. Today, rice field burning is being phased out due to air quality concerns and goals and is being replaced by a program of rice field flooding that decomposes rice stubble and provides additional waterfowl habitat. The result has been an increase in water demand to flood rice fields in October and November, which has increased the need for higher Keswick releases in all but the wettest of fall months.

The recent change in agricultural practice has not been incorporated into the systematic modeling of agricultural practices and hydrology effects, and therefore, the OCAP CALSIM basis used here does not incorporate this effect (see modeling section for a discussion of CALSIM II). The increased water demand for fall rice field flooding and decomposition on the Sacramento River can produce a conflict during this timeframe with the goal of fall fishery flow stability management.

### **Minimum Flow for Navigation – Wilkins Slough**

Historical commerce on the Sacramento River resulted in the requirement to maintain minimum flows of 5,000 cfs at Chico Landing to support navigation. Currently, there is no commercial traffic between Sacramento and Chico Landing, and the Corps has not dredged this reach to preserve channel depths since 1972 (Reclamation 2004). However, long-time water users diverting from the river have set their pump intakes just below this level. Therefore, the CVP is operated to meet the navigation flow requirement of 5,000 cfs to Wilkins Slough, (gauging station on the Sacramento River), under all but the most critical water supply conditions, to facilitate pumping.

At flows below 5,000 cfs at Wilkins Slough, diverters have reported increased pump cavitation

as well as greater pumping head requirements. Diverters are able to operate for extended periods at flows as low as 4,000 cfs at Wilkins Slough, but pumping operations become severely affected and some pumps become inoperable at flows lower than this. Flows may drop as low as 3,500 cfs for short periods while changes are made in Keswick releases to reach target levels at Wilkins Slough, but using the 3,500 cfs rate as a target level for an extended period would have major impacts on diverters.

No criteria have been established specifying when the navigation minimum flow should be relaxed. However, the basis for Reclamation's decision to operate at less than 5,000 cfs is the increased importance of conserving water in storage when water supplies are not sufficient to meet full contractual deliveries and other operational requirements.

### **Water Temperature Operations in the Upper Sacramento River**

Water temperature in the upper Sacramento River has been recognized as a key factor of the habitat needs for Chinook salmon stocks inhabiting the river. Water temperature on the Sacramento River system is influenced by several factors, including the relative water temperatures and ratios of releases from Shasta Dam and from the Spring Creek Powerplant. The temperature of water released from Shasta Dam and the Spring Creek Powerplant is a function of the reservoir temperature profiles at the discharge points at Shasta and Whiskeytown, the depths from which releases are made, the seasonal management of the deep cold water reserves, ambient seasonal air temperatures and other climatic conditions, tributary accretions and water temperatures, and residence time in Keswick, Whiskeytown and Lewiston Reservoirs, and in the Sacramento River.

### **SWRCB Water Rights Order 90-05 and Water Rights Order 91-01**

In 1990 and 1991, the SWRCB issued Water Rights Orders 90-05 and 91-01 (Reclamation 2004) modifying Reclamation's water rights for the Sacramento River. The orders included a narrative water temperature objective for the Sacramento River and stated Reclamation shall operate Keswick and Shasta Dams and the Spring Creek Powerplant to meet a daily average water temperature of 56°F (13°C) at RBDD in the Sacramento River during periods when higher temperature would be harmful to fisheries.

Under the orders, the water temperature compliance point may be modified when the objective cannot be met at RBDD. In addition, Order 90-05 (Reclamation 2004) modified the minimum flow requirements initially established in the 1960 MOA for the Sacramento River below Keswick Dam (Reclamation 2004). The water right orders also recommended the construction of a Shasta Temperature Control Device (TCD) to improve the management of the limited cold water resources.

Pursuant to SWRCB Orders 90-05 and 91-01, Reclamation configured and implemented the Sacramento-Trinity Water Quality Monitoring Network to monitor temperature and other parameters at key locations in the Sacramento and Trinity Rivers. The SWRCB orders also required Reclamation to establish the Sacramento River Temperature Task Group to formulate,

monitor, and coordinate temperature control plans for the upper Sacramento and Trinity Rivers. This group consists of representatives from Reclamation, SWRCB, NOAA Fisheries, Service, DFG, Western, DWR, and the Hoopa Valley Indian Tribe.

Each year, with finite cold water resources and competing demands usually an issue, the Temperature Task Group has been effective in devising operation plans with the flexibility to provide the best protection consistent with the CVP's temperature control capabilities and considering the annual needs and seasonal spawning distribution monitoring information for winter-run and fall-run Chinook salmon. In every year since the SWRCB issued the orders, those plans have included modifying the RBDD compliance point to make best use of the cold water resources based on the location of spawning Chinook salmon.

### **Shasta Temperature Control Device**

Construction of the TCD at Shasta Dam was completed in 1997. This device is designed for greater flexibility in managing the cold water reserves in Shasta Lake while enabling hydroelectric power generation to occur and to improve salmon habitat conditions in the upper Sacramento River. The TCD is also designed to enable selective release of water from varying lake levels through the power plant in order to manage and maintain adequate water temperatures in the Sacramento River downstream of Keswick Dam.

Prior to construction of the TCD, Reclamation released water from Shasta Dam's low-level river outlets to alleviate high water temperatures during critical periods of the spawning and incubation life stages of the winter-run Chinook stock. Releases through the low-level outlets bypass the power plant and result in a loss of hydroelectric generation at the Shasta Powerplant. The release of water through the low-level river outlets was a major facet of Reclamation's efforts to control upper Sacramento River temperatures from 1987 through 1996.

The seasonal operation of the TCD is generally as follows: during mid-winter and early spring the highest elevation gates possible are utilized to draw from the upper portions of the lake to conserve deeper colder resources (see Table 4). During late spring and summer, the operators begin the seasonal progression of opening deeper gates as Shasta Lake elevation decreases and cold water resources are utilized. In late summer and fall, the TCD side gates are opened to utilize the remaining cold water resource below the Shasta Powerplant elevation in Shasta Lake.

**Table 4 Shasta Temperature Control Device Gates with Elevation and Storage**

<b>TCD Gates</b>	<b>Shasta Elevation with 35 feet of submergence</b>	<b>Shasta Storage</b>
Upper Gates	1035	~3.65 MAF
Middle Gates	985	~2.50 MAF
Pressure Relief Gates	850	~0.67 MAF
Side Gates		

The seasonal progression of the TCD operation is designed to maximize the conservation of cold

water resources deep in Shasta Lake, until the time the resource is of greatest management value to fishery management purposes. Recent operational experience with the TCD has demonstrated significant operational flexibility improvement for cold water conservation and upper Sacramento River water temperature and fishery habitat management purposes. Recent operational experience has also demonstrated the TCD has significant leaks that are inherent to TCD design. Also, operational uncertainties cumulatively impair the seasonal performance of the TCD to a greater degree than was anticipated in previous analysis and modeling used to describe long-term TCD benefits.

***Act related Upper Sacramento River temperature objectives.***

In February 1993, NOAA Fisheries issued the long-term BO for the Operation of the Projects for the Sacramento River winter-run Chinook salmon (Reclamation 2004). The BO includes a RPA addressing CVP operations criteria for temperature control objectives. The Shasta-Trinity Division section of the 1993 BO includes the following operational elements relating to temperature control objectives. This section of the RPA was not modified in the 1995 amendment to the BO.

Under the current RPA, Reclamation must make its February 15 forecast of deliverable water based on an estimate of precipitation and runoff at least as conservatively as 90 percent probability of exceedance. Subsequent updates of water delivery commitments must be based on at least as conservatively as 90 percent probability of exceedance forecast.

The use of the conservatively based forecasting approach reduces the risk of over committing potential annual cold water reserves by limiting the Central Valley water supply estimates to a one in ten chance of remaining annual hydrologic conditions being drier than the estimate. This forecasting strategy places an allocation emphasis on reserving sufficient cold water resources during the winter-run Chinook salmon incubation and spawning seasons. The BO also requires a technical demonstration that the water temperature compliance point for winter-run needs can be met using the 90 percent hydrology.

Under the current RPA, Reclamation must maintain a minimum end-of-water-year (September 30) carryover storage in Shasta Reservoir of 1.9 maf. The 1.9 maf Shasta Reservoir carryover target is intended to increase the probability of sufficient cold water resources to maintain suitable water temperature conditions for the following water year winter-run incubation and spawning season needs.

The carryover target does not ensure that adequate cold water reserves (and therefore, winter-run incubation and spawning habitat water temperature) are available during the year the 1.9 maf carryover is required. The BO recognized that it may not be possible to maintain the minimum carryover of 1.9 maf in the driest ten percent of hydrologic circumstances. If Reclamation forecasts end-of-water-year storage levels in Shasta will drop below 1.9 maf, re-initiation of consultation is required prior to the first water allocation announcement for that year.

The current RPA sets water temperature compliance location(s) from April 15 through October 31 for winter-run needs based on a systematic set of Shasta carryover and annual hydrologic

conditions.

The BO segregates annual Shasta Reservoir carryover and hydrologic conditions in order to assess the potential cold water resources available from Trinity Reservoir and Shasta Reservoir and to determine a strategy for water temperature compliance location. Generally, the BO sets the compliance location at Bend Bridge on the Sacramento River in conditions of high carryover storage or above normal hydrologic conditions.

For lower carryover storage conditions and dry or critical hydrologic conditions, the BO sets the compliance location at a further upstream location of Jelly's Ferry on the Sacramento River. For low carryover storage and critical or very critical hydrologic conditions (generally associated with extended drought conditions) the BO requires re-initiation of consultation to determine the temperature compliance location.

In almost every year since 1993, Reclamation has reconsulted with NOAA Fisheries to modify the compliance point or allow short-term fluctuation above the 56° F (13°C) objective because of insufficient cold water resources, extreme ambient air temperature events, or high downstream tributary flows of warm water. The reconsultation actions have been coordinated through the SRTTG to the extent possible. Decisions by Reclamation to reconsult and the resulting decisions by NOAA Fisheries have reflected the best available information on cold water resources and locations of Chinook salmon spawning activity.

### **Reclamation's Proposed Upper Sacramento River Temperature Objectives**

Since the issuance of the temperature objectives contained in the February 1993 NOAA Fisheries BO, the long-term cold water management operation of the Trinity-Shasta reservoir system has been changed and influenced by several significant water management actions that have occurred during the intervening period. The water management actions include:

- Implementation of CVPIA Section 3406 (b)(2)
- Implementation of D-1641
- Continuing implementation of the Trinity ROD as currently ordered by the District Court
- Installation and actual performance characteristics of the TCD

Each of these water management actions has changed the availability and the management of cold water resources to the Upper Sacramento River. Future actions addressed in the Proposed Action will affect temperature control as demands on the yield of Shasta Reservoir increase. Concurrently, the spawning distribution of salmon in the upper Sacramento River has changed. Improved fish passage management actions at RBDD and the Anderson-Cottonwood Irrigation District (ACID) Diversion Dam have allowed winter-run salmon to utilize spawning habitat closer to Keswick Dam. Recent review of the spawning distribution for winter-run salmon has shown conclusively the vast majority spawn above the Ball's Ferry location, with only minor spawning below the Ball's Ferry location.

Reclamation will continue a policy of developing annual operations plans and water allocations based on a conservative 90 percent exceedance forecast. Reclamation is not assuming a minimum end-of-water-year (September 30) carryover storage in Shasta Reservoir. In continuing compliance with Water Rights Orders 90-05 and 91-01 requirements, Reclamation will implement operations to provide year round temperature protection in the upper Sacramento River, consistent with intent of Order 90-05 that protection be provided to the extent controllable. Among factors that affect the extent to which river temperatures will be controllable will include TCD performance, the availability of cold water, the balancing of habitat needs for different species in spring, summer, and fall, and the constraints on operations created by the combined effect of the projects and demands assumed to be in place in the future. Based on cumulative affects of changes to cold water resources and spawning distribution changes, Reclamation has analyzed the capability to manage water temperatures in the upper Sacramento River under future conditions. Reclamation used the water temperature model with an updated calibration of the TCD and the salmon mortality model with the recent spawning distribution to compare results of targeting different compliance points. One set of results represented operating to target compliance points identified in the 1993 BO (Reclamation 2004). Another set of results represented operating to target compliance at Ball's Ferry, which is further upstream. The analysis under future conditions supports moving the target compliance point upstream to avoid exhausting the available cold water resources too early in the salmon spawning and rearing season.

Under all but the most adverse drought and low Shasta Reservoir storage conditions, CVP facilities should be operated to provide water temperature control at Ball's Ferry or at locations further downstream (as far as Bend Bridge) based on annual plans developed in coordination with the SRTTG. Reclamation and the SRTTG will take into account projections of cold water resources, numbers of expected spawning salmon, and spawning distribution (as monitoring information becomes available) to make the decisions on allocation of the cold water resources. Locating the target temperature compliance at Ball's Ferry (1) reduces the need to compensate for the warming effects of Cottonwood Creek and Battle Creek during the spring runoff months with deeper cold water releases and (2) improves the reliability of cold water resources through the fall months. Reclamation proposes this change in Sacramento River temperature control objectives to be consistent with the capability of the CVP to manage cold water resources and to use the process of annual planning in coordination with the Sacramento River Temperature Task Group to arrive at the best use of that capability.

### **Anderson-Cottonwood Irrigation District Diversion Dam**

Since 1916, water has been diverted into the ACID Canal for irrigation along the west side of the Sacramento River between Redding and Cottonwood. The United States and ACID signed a contract (Number 14-06-200-3346A) (Reclamation 2004) providing for the project water service and agreement on diversion of water. ACID diverts to its main canal (on the right bank of the river) from a diversion dam located in Redding about five miles downstream from Keswick Dam. The diversion dam consists of boards supported by a pinned steel superstructure anchored to a concrete foundation across the Sacramento River. The boards are manually set from a walkway supported by the steel superstructure. The number of boards set in the dam varies

depending upon flow in the river and desired head in the canal.

Because the diversion dam is a flashboard dam installed for seasonal use only, close coordination is required between Reclamation and ACID for regulation of river flows to allow safe installation and removal of the flashboards. The contract between ACID and the United States allows for ACID to notify Reclamation as far in advance as possible each time it intends to install or remove boards from its diversion dam. Reclamation similarly notifies ACID each time it intends to change releases at Keswick Dam. In addition, during the irrigation season, ACID notifies Reclamation of the maximum flow the diversion dam can safely accommodate (with the current setting of boards). Reclamation notifies ACID (at least 24 hours in advance) of any change in releases at Keswick Dam that exceed such maximum flow designated by ACID.

The irrigation season for ACID runs from April through October. Therefore, around April 1 of each year, ACID erects the diversion dam. This consists of raising the steel superstructure, installing the walkway, and then setting the boards. Around November 1 of each year, the reverse process occurs. The dates of installation and removal can vary depending on hydrologic conditions. Removal and installation of the dam cannot be done safely at flows greater than 6,000 cfs. ACID usually requests Reclamation to limit the Keswick release to a 5,000 cfs maximum for five days to accomplish the installation and removal of the dam. As indicated previously, there may be times during the irrigation season when the setting of the boards must be changed due to changes in releases at Keswick Dam. When boards must be removed due to an increase at Keswick, the release may initially have to be decreased to allow work to be done safely. If an emergency exists, Reclamation personnel from the Northern California Area Office can be dispatched to assist ACID in removing the boards.

Keswick release rate decreases required for the ACID operations are limited to 15 percent in a 24-hour period and 2.5 percent in any one hour. Therefore, advance notification is important when scheduling decreases to allow for the installation or removal of the ACID dam.

### **Red Bluff Diversion Dam Operations**

The RBDD, located on the Sacramento River approximately two miles southeast of Red Bluff, is a gated structure with fish ladders at each abutment. When the gates are lowered, the impounded water rises about 13 feet, creating Lake Red Bluff and allowing gravity diversions through a set of drum screens into the a stilling basin servicing the Tehama-Colusa and Corning Canals. Construction of RBDD was completed in 1964.

The Tehama-Colusa Canal is a lined canal extending 111 miles south from the RBDD and provides irrigation service on the west side of the Sacramento Valley in Tehama, Glenn, Colusa, and northern Yolo counties. The RBDD diverts water to the Corning and Tehama-Colusa Canals. Construction of the Tehama-Colusa Canal began in 1965, enlargement approved in 1967, first operational in 1969 and was completed in 1980.

The Corning Pumping Plant lifts water approximately 56 feet from the screened portion of the settling basin into the unlined, 21 mile-long Corning Canal. The Corning Canal was completed

in 1959 to serve water to the CVP contractors in Tehama County that could not be served by gravity from the Tehama-Colusa Canal. Both Canals are operated by the Tehama-Colusa Canal Authority (TCCA). The gates are currently lowered on May 15 to impound water for diversion and raised on September 15 to allow river flow-through.

Since 1986, the RBDD gates have been raised during winter months to allow passage of winter-run Chinook salmon. Since the 1993 NOAA Fisheries BO for winter-run Chinook salmon (Reclamation 2004), the gates have been raised from September 15 through May 14 each year. This eight-month gates-up operation has eliminated passage impedance of upstream migration for all species which need to migrate above the RBDD to spawn, with the exception of 70 percent of the spring-run Chinook and an estimated 35 percent of the green sturgeon migrants (TCCA and Reclamation, 2002).

Reclamation proposes the continued operation of the RBDD using the eight-month gate-open procedures of the past ten years. However, Reclamation proposes to change the status of the research pumping plant from research to production status, along with adding a fourth pump if funding becomes available and the cost-benefit ratios prove favorable. Should a fourth pump be added, Reclamation would install another centrifugal pump. Reclamation also proposes the continued use of rediversions of CVP water stored in Black Butte Reservoir to supplement the water pumped at RBDD during the gates-out period. This water is rediverted with the aid of temporary gravel berms through an unscreened, constant head orifice into the Tehama-Colusa Canal.

This arrangement has successfully met the water demand for the past ten years, but the supply has consistently been quite tight. To date, Reclamation has not had to use the provision of the RPA of the winter-run BO allowing up to one closure per year of the gates for up to ten days. While mandatory use of this temporary gates closure provision has been minimized so far, it was used in 1997, a year with an exceptionally dry spring. Its use in another year was avoided only at the last minute by an exceptionally heavy, late storm. Reclamation will implement with NOAA Fisheries a decision-making protocol to ensure such gate closure decisions can be achieved on short notice.

### **American River Division**

The American River originates in the mountains of the Sierra Nevada range, drains a watershed of approximately 1,895 square miles, and enters the Sacramento River at river mile 60 in the City of Sacramento. The American River contributes approximately 15 percent of the total flow in the Sacramento River. The American River watershed ranges in elevation from 23 feet to over 10,000 feet, and receives approximately 40 percent of its flow from snowmelt. Development on the American River began in the earliest days of the California Gold Rush, when numerous small diversion dams, flumes, and canals were constructed. Currently, 19 major reservoirs in the drainage area have a combined storage capacity of about 1.8 maf.

Folsom Lake, the largest reservoir in the watershed, was formed with the completion of Folsom Dam in 1956 and has a capacity of 977,000 af. Folsom Dam, located approximately 30 miles

upstream from the confluence with the Sacramento River, is operated by Reclamation as a major component of the CVP. Water released from Folsom Lake is used to generate hydroelectric power, meet downstream water rights obligations, contribute to Delta inflow requirements, and provide water supplies to CVP contractors.

Releases from Folsom Dam are re-regulated approximately seven miles downstream by Nimbus Dam. This facility is also operated by Reclamation as part of the CVP and began operation in 1955. Nimbus Dam creates Lake Natoma, which serves as a forebay for diversions to the Folsom South Canal. This CVP facility began operation in 1973 and serves water to agricultural and M&I users in Sacramento County. The first two reaches of the canal, extending to just south of Highway 104, were completed in 1973. Construction of the remainder of the canal has been suspended pending reconsideration of alternatives. Releases from Nimbus Dam to the American River pass through the Nimbus Powerplant, or, at flows in excess of 5,000 cfs, the spillway gates.

Although Folsom Lake is the main storage and flood control reservoir on the American River, numerous other small reservoirs in the upper basin provide hydroelectric generation and water supply. None of the upstream reservoirs has any specific flood control responsibilities. The total upstream reservoir storage above Folsom Lake is approximately 820,000 af. Ninety percent of this upstream storage is contained by five reservoirs: French Meadows (136,000 af); Hell Hole (208,000 af); Loon Lake (76,000 af); Union Valley (271,000 af); and Ice House (46,000 af).

French Meadows and Hell Hole reservoirs, located on the Middle Fork of the American River, are owned and operated by the Placer County Water Agency (PCWA). The PCWA provides wholesale water to agricultural and urban areas within Placer County. For urban areas, the PCWA operates water treatment plants and sells wholesale treated water to municipalities that provide retail delivery to their customers. The cities of Rocklin and Lincoln receive water from the PCWA. Loon Lake (also on the Middle Fork), and Union Valley and Ice House reservoirs on the South Fork, are all operated by the Sacramento Municipal Utilities District (SMUD) for hydropower purposes.

### **American River Operations**

The Corps constructed major portions of the American River Division under the authorization of Congress. The American River Basin Development Act of 1949 subsequently authorized its integration into the CVP. The American River Division includes facilities that provide conservation of water on the American River for flood control, fish and wildlife protection, recreation, protection of the Delta from intrusion of saline ocean water, irrigation and M&I water supplies, and hydroelectric power generation. Initially authorized features of the American River Division included Folsom Dam, Lake, and Powerplant; Nimbus Dam and Powerplant, and Lake Natoma.

Flood control requirements and regulating criteria are specified by the Corps and described in the Folsom Dam and Lake, American River, California Water Control Manual (Corps 1987). Flood control objectives for Folsom require the dam and lake are operated to:

- Protect the City and other areas within the lower American River floodplain against reasonable probable rain floods.
- Control flows in the American River downstream from Folsom Dam to existing channel capacities, insofar as practicable, and to reduce flooding along the lower Sacramento River and in the Delta in conjunction with other CVP projects.
- Provide the maximum amount of water conservation storage without impairing the flood control functions of the reservoir.
- Provide the maximum amount of power practicable and be consistent with required flood control operations and the conservation functions of the reservoir.

From June 1 through September 30, no flood control storage restrictions exist. From October 1 through November 16 and from April 20 through May 31, reserving storage space for flood control is a function of the date only, with full flood reservation space required from November 17 through February 7. Beginning February 8 and continuing through April 20, flood reservation space is a function of both date and current hydrologic conditions in the basin.

If the inflow into Folsom Reservoir causes the storage to encroach into the space reserved for flood control, releases from Nimbus Dam are increased. Flood control regulations prescribe the following releases when water is stored within the flood control reservation space:

- Maximum inflow (after the storage entered into the flood control reservation space) of as much as 115,000 cfs, but not less than 20,000 cfs, when inflows are increasing.
- Releases will not be increased more than 15,000 cfs or decreased more than 10,000 cfs during and two-hour period.
- Flood control requirements override other operational considerations in the fall and winter period. Consequently, changes in river releases of short duration may occur.

In February 1986, the American River Basin experienced a significant flood event. Folsom Dam and Reservoir moderated the flood event and performed the flood control objectives, but with serious operational strains and concerns in the lower American River and the overall protection of the communities in the floodplain areas. A similar flood event occurred in January 1997. Since then, significant review and enhancement of lower American River flooding issues has occurred and continues to occur. A major element of those efforts has been the SAFCA-sponsored flood control plan diagram for Folsom Reservoir.

Since 1996, Reclamation has operated according to modified flood control criteria, which reserve 400 to 670 thousand acre feet (TAF) of flood control space in Folsom and in a combination of three upstream reservoirs. This flood control plan, which provides additional protection for the Lower American River, is implemented through an agreement between Reclamation and the SAFCA. The terms of the agreement allow some of the empty reservoir space in Hell Hole,

Union Valley, and French Meadows to be treated as if it were available in Folsom.

The SAFCA release criteria are generally equivalent to the Corps plan, except the SAFCA diagram may prescribe flood releases earlier than the Corps plan. The SAFCA diagram also relies on Folsom Dam outlet capacity to make the earlier flood releases. The outlet capacity at Folsom Dam is currently limited to 32,000 cfs based on lake elevation. However, in general the SAFCA plan diagram provides greater flood protection than the existing the Corps plan for communities in the American River floodplain.

Required flood control space under the SAFCA diagram will begin to decrease on March 1. Between March 1 and April 20, the rate of filling is a function of the date and available upstream space. As of April 21, the required flood reservation is about 225,000 af. From April 21 to June 1, the required flood reservation is a function of the date only, with Folsom storage permitted to fill completely on June 1.

### **Fish and Wildlife Requirements in the Lower American River**

The minimum allowable flows in the lower American River are defined by SWRCB Decision 893 (D-893) (Reclamation 2004) which states that, in the interest of fish conservation, releases should not ordinarily fall below 250 cfs between January 1 and September 15 or below 500 cfs at other times. D-893 minimum flows are rarely the controlling objective of CVP operations at Nimbus Dam. Nimbus Dam releases are nearly always controlled during significant portions of a water year by either flood control requirements or are coordinated with other CVP and SWP releases to meet downstream Sacramento-San Joaquin Delta WQCP requirements and CVP water supply objectives.

Power regulation and management needs occasionally control Nimbus Dam releases. Nimbus Dam releases are expected to exceed the D-893 minimum flows in all but the driest of conditions. Reclamation is participating in continuing discussions with the Sacramento Water Forum, Service, NOAA Fisheries, DFG, and other interested parties regarding integration of a revised flow standard for the lower American River into CVP operations and water rights. Reclamation intends to accomplish such incorporation, including associated revisions to the OCAP Project Description, in coordination with the parties. That revised project description, amending the lower American River flows to make them consistent with the revised flow standard, will be presented to the agencies, together with supporting material and analysis needed for review under Section 7 of the Act. Until such an action is presented to and adopted by the SWRCB, minimum flows will be limited by D-893. Releases of additional water are made pursuant to Section 3406 (b)(2) of the CVPIA.

Water temperature control operations in the lower American River are affected by many factors and operational tradeoffs. These include available cold water resources, Nimbus release schedules, annual hydrology, Folsom power penstock shutter management flexibility, Folsom Dam Urban Water Supply TCD management, and Nimbus Hatchery considerations. Shutter and TCD management provide the majority of operational flexibility used to control downstream temperatures.

During the late 1960s, Reclamation designed a modification to the trashrack structures to provide selective withdrawal capability at Folsom Dam. Folsom Powerplant is located at the foot of Folsom Dam on the right abutment. Three 15-foot-diameter steel penstocks for delivering water to the turbines are embedded in the concrete section of the dam. The centerline of each penstock intake is at elevation 307.0 feet and the minimum power pool elevation is 328.5 feet. A reinforced concrete trashrack structure with steel trashracks protects each penstock intake.

The steel trashracks, located in five bays around each intake, extend the full height of the trashrack structure (between 281 and 428 feet). Steel guides were attached to the upstream side of the trashrack panels between elevation 281 and 401 feet. Forty-five 13-foot steel shutter panels (nine per bay) and operated by the gantry crane, were installed in these guides to select the level of withdrawal from the reservoir. The shutter panels are attached to one another in a configuration starting with the top shutter in groups of 3-2-4.

Selective withdrawal capability on the Folsom Dam Urban Water Supply Pipeline became operational in 2003. The centerline to the 84-inch-diameter Urban Water Supply intake is at elevation 317 feet. An enclosure structure extending from just below the water supply intake to an elevation of 442 feet was attached to the upstream face of Folsom Dam. A telescoping control gate allows for selective withdrawal of water anywhere between 331 and 401 feet elevation under normal operations.

The current objectives for water temperatures in the lower American River address the needs for steelhead incubation and rearing during the late spring and summer, and for fall-run Chinook spawning and incubation starting in late October or early November.

The steelhead temperature objectives in the lower American River, as provided by NOAA Fisheries, state:

Reclamation shall, to the extent possible, control water temperatures in the lower river between Nimbus Dam and the Watt Avenue Bridge (River mile (RM) 9.4) from June 1 through November 30, to a daily average temperature of less than or equal to 65°F to protect rearing juvenile steelhead from thermal stress and from warm water predator species. The use of the cold water pool in Folsom Reservoir should be reserved for August through October releases.

Prior to the listing of steelhead and the subsequent BOs on operations, the cold water resources in Folsom Reservoir were used to lower downstream temperatures in the fall when fall-run Chinook salmon entered the lower river and began to spawn. The flexibility once available is now gone because of the need to use the cold water to maintain suitable summer steelhead rearing conditions. The operational objective in the fall spawning season is to provide 60°F (16°C) or less in the lower river, as soon as available cold water supplies can be used.

A major challenge is determining the starting date at which time the objective is met. Establishing the start date requires a balancing between forecasted release rates, the volume of

available cold water, and the estimated date at which time Folsom Reservoir turns over and becomes isothermic. Reclamation will start providing suitable spawning temperatures as early as possible (after November 1) to avoid temperature related pre-spawning mortality of adults and reduced egg viability. Reclamation will be balanced against the possibility of running out of cold water and increasing downstream temperatures after spawning is initiated and creating temperature related effects to eggs already in the gravel.

The cold water resources available in any given year at Folsom Lake needed to meet the stated water temperature goals are often insufficient. Only in wetter hydrologic conditions is the volume of cold water resources available sufficient to meet all the water temperature objectives. Therefore, significant operations tradeoffs and flexibilities are considered part of an annual planning process for coordinating an operation strategy that realistically manages the limited cold water resources available.

The management process begins in the spring as Folsom Reservoir fills. All penstock shutters are put in the down position to isolate the colder water in the reservoir below an elevation of 401 feet. The reservoir water surface elevation must be at least 25 feet higher than the sill of the upper shutter (426 feet) to avoid cavitation of the power turbines. The earliest this can occur is in the month of March, due to the need to maintain flood control space in the reservoir during the winter. The pattern of spring run-off is then a significant factor in determining the availability of cold water for later use. Folsom inflow temperatures begin to increase and the lake starts to stratify as early as April. By the time the reservoir is filled or reaches peak storage (sometime in the May through June period), the reservoir is highly stratified with surface waters too warm to meet downstream temperature objectives. There are, however, times during the filling process when use of the spillway gates can be used to conserve cold water.

In the spring of 2003, high inflows and encroachment into the allowable storage space for flood control required releases that exceeded the available capacity of the power plant. Under these conditions, standard operations of Folsom calls for the use of the river outlets that would draw upon the cold water pool. Instead, Reclamation reviewed the release requirements, safety of dams issues, reservoir temperature conditions, and the benefits to the cold water pool and determined that it could use the spillway gates to make the incremental releases above powerplant capacity, thereby conserving cold water for later use. The ability to take similar actions, (as needed in the future), will be evaluated on a case-by-case basis.

A temperature control management strategy must be developed that balances conservation of cold water for later use in the fall, with the more immediate needs of steelhead during the summer. The planning and forecasting process for the use of the cold water pool begins in the spring as Folsom Reservoir fills. Actual Folsom Reservoir cold water resource availability becomes significantly more defined through the assessment of reservoir water temperature profiles and more definite projections of inflows and storage. Technical modeling analysis of the projected lower American River water temperature management can begin. The significant variables and key assumptions in the analysis include:

- Starting reservoir temperature conditions

- Forecasted inflow and outflow quantities
- Assumed meteorological conditions
- Assumed inflow temperatures
- Assumed Urban Water Supply TCD operations

A series of shutter management scenarios are then incorporated into the model to gain a better understanding of the potential for meeting both summer steelhead and fall salmon temperature needs. Most annual strategies contain significant tradeoffs and risks for water temperature management for steelhead and fall-run salmon goals and needs due to the frequently limited cold water resource. The planning process continues throughout the summer. New temperature forecasts and operational strategies are updated as more information on actual operations and ambient conditions is gained. This process is shared with the AROG.

Meeting both the summer steelhead and fall salmon temperature objectives without negatively impacting other CVP project purposes requires the final shutter pull be reserved for use in the fall to provide suitable fall-run Chinook salmon spawning temperatures. In most years, the volume of cold water is not sufficient to support strict compliance with the summer temperature target at the downstream end of the compliance reach (Watt Avenue Bridge) and reserve the final shutter pull for salmon or, in some cases, continue to meet steelhead objectives later in the summer. A strategy that is used under these conditions is to allow the annual compliance location water temperatures to warm towards the upper end of the annual water temperature design value before making a shutter pull. This management flexibility is essential to the annual management strategy to extend the effectiveness of cold water management through the summer and fall months.

The Urban Water Supply TCD has provided additional flexibility to conserve cold water for later use. Initial studies are being conducted evaluating the impact of warmer water deliveries to the water treatment plants receiving the water. As water supply temperatures increase into the upper-60°F (16°C) range, treatment costs, the potential for taste and odor and disinfection byproducts, and customer complaints increase. It is expected that the TCD will be operated during the summer months and deliver water that is slightly warmer than that which could be used to meet downstream temperatures (60°F (16°C) to 62°F (17°C)), but not so warm as to cause significant treatment issues.

Water temperatures feeding the Nimbus Fish Hatchery were historically too high for hatchery operations during some dry or critical years. Temperatures in the Nimbus Hatchery are generally in the desirable range of 42°F (6°C) to 55°F (13°C), except for the months of June, July, August, and September. When temperatures get above 60°F (16°C) during these months, the hatchery must begin to treat the fish with chemicals to prevent disease. When temperatures reach the 60°F (16°C) to 70°F (21°C) range, treatment becomes difficult and conditions become increasingly dangerous for the fish. When temperatures climb into the 60°F (16°C) to 70°F (21°C) range, hatchery personnel may confer with Reclamation to determine a compromise operation of the temperature shutter at Folsom Dam for the release of cooler water.

The goal is to maintain the health of the hatchery fish while minimizing the loss of the cold water

pool for fish spawning in the river during fall. This is done on a case-by-case basis and is different in various months and year types. Temperatures above 70°F (21°C) in the hatchery usually mean the fish need to be moved to another hatchery. The real time implementation needs for the CVPIA AFRP objective flow management and D-1641 (Reclamation 2004) standards from the limited water resources of the lower American River has made cold water resource management at Folsom Lake a significant compromise coordination effort. Reclamation consults with the Service, NOAA Fisheries, and the DFG using the B2IT process (see CVPIA section) when making the difficult compromise decisions. In addition, Reclamation communicates and coordinates with the AROG on real time decision issues.

The Nimbus Fish Hatchery and the American River Trout Hatchery were constructed to mitigate the loss of riverine habitat caused by the construction of Nimbus and Folsom Dam. The hatcheries are located approximately one-quarter mile downstream from Nimbus Dam on the south side of the American River. To meet the mitigation requirement, annual production goals are approximately 4.2 million salmon smolts and 430,000 steelhead yearlings.

A fish diversion weir at the hatcheries blocks Chinook salmon from continuing upstream and guides them to the hatchery fish ladder entrance. The fish diversion weir consists of eight piers on 30-foot spacing, including two riverbank abutments. Fish rack support frames and walkways are installed each fall via an overhead cable system. A pipe rack is then put in place to support the pipe pickets (¾-inch steel rods spaced on 2½-inch centers). The pipe rack rests on a submerged steel I-beam support frame that extends between the piers and forms the upper support structure for a rock filled crib foundation. The rock foundation has deteriorated with age and is subject to annual scour which can leave holes in the foundation that allow fish to pass if left unattended.

Fish rack supports and pickets are installed around September 15 of each year and correspond with the beginning of the fall-run Chinook salmon spawning season. A release equal to or less than 1,500 cfs from Nimbus Dams is required for safety and to provide full access to the fish rack supports. It takes six people approximately three days to install the fish rack supports and pickets. In years after high winter flows have caused active scour of the rock foundation, a short period (less than eight hours) of lower flow (approximately 500 cfs) is needed to remove debris from the I-beam support frames, seat the pipe racks, and fill holes in the rock foundation. Complete installation can take up to seven days, but is generally completed in less time. The fish rack supports and pickets are usually removed at the end of fall-run Chinook salmon spawning season (mid-January) when flows are less than 2,000 cfs. If Nimbus Dam releases are expected to exceed 5,000 cfs during the operational period, the pipe pickets are removed until flows decrease.

## **East Side Division**

### **New Melones Operations**

The Stanislaus River originates in the western slopes of the Sierra Nevada Mountain Range and drains a watershed of approximately 900 square miles. The average unimpaired runoff in the

basin is approximately 1.2 maf per year; the median historical unimpaired runoff is 1.1 maf per year. Snowmelt contributes the largest portion of the flows in the Stanislaus River, with the highest runoff occurring in the months of April, May, and June. Agricultural water supply development in the Stanislaus River watershed began in the 1850s and has significantly altered the basin's hydrologic conditions.

Currently, the flow in the lower Stanislaus River is primarily controlled by New Melones Reservoir, which has a storage capacity of about 2.4 maf. The reservoir was completed by the Corps in 1978 and approved for filling in 1983. New Melones Reservoir is located approximately 60 miles upstream from the confluence of the Stanislaus River and the San Joaquin River and is operated by Reclamation. Congressional authorization for New Melones integrates New Melones Reservoir as a financial component of the CVP, but it is authorized to provide water supply benefits within the defined Stanislaus Basin per a 1980 ROD (Reclamation 2004) before additional water supplies can be used out of the defined Stanislaus Basin.

New Melones Reservoir is operated primarily for purposes of water supply, flood control, power generation, fishery enhancement, and water quality improvement in the lower San Joaquin River. The reservoir and river also provide recreation benefits. Flood control operations are conducted in conformance with the Corps's operational guidelines.

Another major water storage project in the Stanislaus River watershed is the Tri-Dam Project, a hydroelectric generation project that consists of Donnell's and Beardsley Dams, located upstream of New Melones Reservoir on the middle fork Stanislaus River, and Tulloch Dam and Powerplant, located approximately 6 miles downstream of New Melones Dam on the main stem Stanislaus River.

Releases from Donnell's and Beardsley Dams affect inflows to New Melones Reservoir. Under contractual agreements between Reclamation, the Oakdale Irrigation District (OID) (Reclamation 2004), and South San Joaquin Irrigation District (SSJID), Tulloch Reservoir provides afterbay storage to re-regulate power releases from New Melones Powerplant. The main water diversion point on the Stanislaus River is Goodwin Dam, located approximately 1.9 miles downstream of Tulloch Dam.

Goodwin Dam, constructed by OID and SSJID in 1912, creates a re-regulating reservoir for releases from Tulloch Powerplant and provides for diversions to canals north and south of the Stanislaus River for delivery to OID and SSJID. Water impounded behind Goodwin Dam may be pumped into the Goodwin Tunnel for deliveries to the Central San Joaquin Water Conservation District and the Stockton East Water District.

Twenty ungaged tributaries contribute flow to the lower portion of the Stanislaus River, below Goodwin Dam. These streams provide intermittent flows, occurring primarily during the months of November through April. Agricultural return flows, as well as operational spills from irrigation canals receiving water from both the Stanislaus and Tuolumne Rivers, enter the lower portion of the Stanislaus River. In addition, a portion of the flow in the lower reach of the Stanislaus River originates from groundwater accretions.

## **Flood Control**

The New Melones Reservoir flood control operation is coordinated with the operation of Tulloch Reservoir. The flood control objective is to maintain flood flows at the Orange Blossom Bridge at less than 8,000 cfs. When possible, however, releases from Tulloch Dam are maintained at levels that would not result in downstream flows in excess of 1,250 cfs to 1,500 cfs because of seepage problems in agricultural lands adjoining the river associated with flows above this level. Up to 450,000 af of the 2.4 maf storage volume in New Melones Reservoir is dedicated for flood control and 10,000 af of Tulloch Reservoir storage is set aside for flood control. Based upon the flood control diagrams prepared by the Corps, part or all of the dedicated flood control storage may be used for conservation storage, depending on the time of year and the current flood hazard.

## **Requirements for New Melones Operations**

The operating criteria for New Melones Reservoir are affected by (1) water rights, (2) in-stream fish and wildlife flow requirements (including Interior's CVPIA 3406 (b)(2) fishery management objectives), (3) D-1641 Vernalis flow requirements, (4) dissolved oxygen (DO) requirements, (5) D-1641 Vernalis water quality requirements, (6) CVP contracts, and (7) flood control considerations. Water released from New Melones Dam and Powerplant is re-regulated at Tulloch Reservoir and is either diverted at Goodwin Dam or released from Goodwin Dam to the lower Stanislaus River.

Flows in the lower Stanislaus River serve multiple purposes concurrently. The purposes include water supply for riparian water rights, fishery management objectives, and DO requirements per D-1422 (Reclamation 2004). In addition, water from the Stanislaus River enters the San Joaquin River where it contributes to flow and helps improve water quality conditions at Vernalis. D-1422, issued in 1973, provided the primary operational criteria for New Melones Reservoir and permitted Reclamation to appropriate water from the Stanislaus River for irrigation and M&I uses. D-1422 requires the operation of New Melones Reservoir include releases for existing water rights, fish and wildlife enhancement, and the maintenance of water quality conditions on the Stanislaus and San Joaquin Rivers.

## **Water Rights Obligations**

When Reclamation began operations of New Melones Reservoir in 1980, the obligations for releases (to meet downstream water rights) were defined in a 1972 Agreement and Stipulation among Reclamation, OID, and SSJID (Reclamation 2004). The 1972 Agreement and Stipulation required Reclamation release annual inflows to New Melones Reservoir of up to 654,000 af per year for diversion at Goodwin Dam by OID and SSJID, in recognition of their prior water rights. Actual historical diversions prior to 1972 varied considerably, depending upon hydrologic conditions. In addition to releases for diversion by OID and SSJID, water is released from New Melones Reservoir to satisfy riparian water rights totaling approximately 48,000 af annually downstream of Goodwin Dam.

In 1988, following a year of low inflow to New Melones Reservoir, the Agreement and Stipulation among Reclamation, OID, and SSJID (Reclamation 2004) was superseded by an agreement that provided for conservation storage by OID and SSJID. The new agreement required Reclamation to release New Melones Reservoir inflows of up to 600,000 af each year for diversion at Goodwin Dam by OID and SSJID.

In years when annual inflows to New Melones Reservoir are less than 600,000 af, Reclamation provides all inflows plus one-third the difference between the inflow for that year and 600,000 af per year. The 1988 Agreement and Stipulation (Reclamation 2004) created a conservation account in which the difference between the entitled quantity and the actual quantity diverted by OID and SSJID in a year may be stored in New Melones Reservoir for use in subsequent years. This conservation account has a maximum storage limit of 200,000 af, and withdrawals are constrained by criteria in the agreement.

### **In-stream Flow Requirements**

Under D-1422, Reclamation is required to release 98,000 af of water per year, with a reduction to 69,000 af in critical years, from New Melones Reservoir to the Stanislaus River on a distribution pattern to be specified each year by DFG for fish and wildlife purposes. In 1987, an agreement between Reclamation and DFG (Reclamation 2004) provided for increased releases from New Melones to enhance fishery resources for an interim period, during which habitat requirements were to be better defined and a study of Chinook salmon fisheries on the Stanislaus River would be completed.

During the study period, releases for in-stream flows would range from 98,300 to 302,100 af per year. The exact quantity to be released each year was to be determined based on a formulation involving storage, projected inflows, projected water supply, water quality demands, projected CVP contractor demands, and target carryover storage. Because of dry hydrologic conditions during the 1987 to 1992 drought period, the ability to provide increased releases was limited. The Service published the results of a 1993 study, which recommended a minimum in-stream flow on the Stanislaus River of 155,700 af per year for spawning and rearing (Aceituno 1993).

### **Bay-Delta Vernalis Flow Requirements**

D-1641 sets flow requirements on the San Joaquin River at Vernalis from February to June. These flows are commonly known as San Joaquin River base flows.

**Table 5 San Joaquin Base Flows-Vernalis**

<b>Water Year Class</b>	<b>February-June Flow (cfs)*</b>
Critical	710-1140
Dry	1420-2280
Below Normal	1420-2280
Above Normal	2130-3420
Wet	2130-3420
*the higher flow required when X2 is required to be at or west of Chipps Island	

Reclamation committed to provide these flows during the interim period of the Bay-Delta Accord. Since D-1641 has been in place, the San Joaquin base flow requirements have at times, been an additional demand on the New Melones water supply beyond that anticipated in the Interim Plan of Operation (IPO) (Reclamation 2004). The IPO describes the commitment Reclamation made regarding the operation of New Melones Reservoir.

### **Dissolved Oxygen Requirements**

D-1422 requires that water be released from New Melones Reservoir to maintain Dissolved Oxygen (DO) standards in the Stanislaus River. The 1995 revision to the WQCP established a minimum DO concentration of 7 milligrams per liter (mg/L), as measured on the Stanislaus River near Ripon.

### **Vernalis Water Quality Requirement**

D-1422 also specifies that New Melones Reservoir must operate to maintain average monthly level total dissolved solids (TDS), commonly measured as a conversion from electrical conductivity, in the San Joaquin River at Vernalis as it enters the Delta. D-1422 specifies an average monthly concentration of 500 parts per million (ppm) TDS for all months. Historically, releases have been made from New Melones Reservoir for this standard, but due to shortfalls in water supply, Reclamation has not always been successful in meeting this objective.

In the past, when sufficient supplies were not available to meet the water quality standards for the entire year, the emphasis for use of the available water was during the irrigation season, generally from April through September. D-1641 modified the water quality objectives at Vernalis to include the irrigation and non-irrigation season objectives contained in the WQCP. The revised standard is an average monthly electric conductivity 0.7 milliSiemens per centimeter (mS/cm) (approximately 455 ppm TDS) during the months of April through August, and 1.0 mS/cm (approximately 650 ppm TDS) during the months of September through March.

### **CVP Contracts**

Reclamation entered into water service contracts for the delivery of water from New Melones Reservoir, based on a 1980 hydrologic evaluation of the long-term availability of water in the Stanislaus River Basin. Based on this study, Reclamation entered into a long-term water service

contract for up to 49,000 af per year of water annually (based on a firm water supply), and two long-term water service contracts totaling 106,000 af per year (based on an interim water supply). Because diversion facilities were not yet fully operational and water supplies were not available during the 1987 to 1992 drought, water was not made available from the Stanislaus River for delivery to CVP contractors prior to 1992.

### **New Melones Interim Plan of Operations (IPO)**

Proposed CVP operations on the Stanislaus River are derived from the New Melones IPO. The IPO was developed as a joint effort between Reclamation and THE SERVICE, in conjunction with the Stanislaus River Basin Stakeholders (SRBS). The process of developing the plan began in 1995 with a goal to develop a long-term management plan with clear operating criteria, given a fundamental recognition by all parties that New Melones Reservoir water supplies are over-committed on a long-term basis, and consequently, unable to meet all the potential beneficial uses designated as purposes.

In 1996, the focus shifted to the development of an interim operations plan for 1997 and 1998. At an SRBS meeting on January 29, 1997, a final interim plan of operation was agreed to in concept. The IPO was transmitted to the SRBS on May 1, 1997. Although meant to be a short-term plan, it continues to be the guiding operations criteria in effect for the annual planning to meet beneficial uses from New Melones storage.

In summary, the IPO defines categories of water supply based on storage and projected inflow. It then allocates annual water release for in-stream fishery enhancement (1987 DFG Agreement (Reclamation 2004) and CVPIA Section 3406(b)(2) management), D-1641 San Joaquin River water quality requirements (Water Quality), D-1641 Vernalis flow requirements (Bay-Delta), and use by CVP contractors.

**Table 6 Inflow characterization for the New Melones IPO**

Annual water supply category	March-September forecasted inflow plus end of February storage (thousand af)
Low	0 - 1400
Medium-low	1400 - 2000
Medium	2000 - 2500
Medium-high	2500 - 3000
High	3000 - 6000

**Table 7 New Melones IPO flow objectives (in thousand af)**

Storage plus inflow		Fishery		Vernalis water quality		Bay-Delta		CVP contractors	
From	To	From	To	From	To	From	To	From	To

1400	2000	98	125	70	80	0	0	0	0
2000	2500	125	345	80	175	0	0	0	59
2500	3000	345	467	175	250	75	75	90	90
3000	6000	467	467	250	250	75	75	90	90

From inspection of the above IPO allocation structure, two key New Melones-Stanislaus River water policies are inferred:

When the water supply condition is determined to be in the “Low” IPO designation, no CVP operations guidance is given. It is assumed Reclamation would meet with the SRBS group to coordinate a practical strategy to guide New Melones Reservoir annual operations under the very limited water supply conditions.

The IPO only supports meeting the D-1641 Vernalis Base flow standards from Stanislaus River water resources when the water supply condition are determined to be in the “High” or “Medium-High” IPO designation, and then are limited to 75,000 af of reservoir release.

The IPO supports only limited reservoir release volumes towards meeting the Vernalis salinity standards. The limited reservoir release volumes dedicated in the IPO may not fully meet the annual SWRCB standard requirement for the Vernalis salinity standard in the “Medium Low” and “Medium” years. If the Vernalis salinity standard cannot be met using the IPO designated Goodwin release pattern, then additional volume is dedicated to meeting the salinity standard. The permit obligations must be met before an allocation can be made to CVPIA Section 3406 (b)(2) uses or CVP contracts. This is a consequence of Vernalis salinity standards existing prior to passage of CVPIA.

In water years 2002, 2003 and 2004, Reclamation deviated from the IPO to provide additional releases for Vernalis salinity and Vernalis base flow standards. Several consecutive years of dry hydrology in the San Joaquin River Basin have demonstrated the limited ability of New Melones to fully satisfy the demands placed on its yield. Despite the need to consider annual deviations, the IPO remains the initial guidance for New Melones Reservoir operations.

CVPIA Section 3406 (b)(2) releases from New Melones Reservoir consist of the portion of the fishery flow management volume utilized that is greater than the 1987 DFG Agreement (Reclamation 2004) and the volume used in meeting the Vernalis Base flows.

### **San Joaquin River Agreement/Vernalis Adaptive Management Plan**

Adopted by the SWRCB in D-1641, the SJRA (Reclamation 2004) includes a 12-year experimental program providing for flows and exports in the lower San Joaquin River during a 31-day pulse flow period during April and May. It also provides for the collection of experimental data during that time to further the understanding of the effects of flows, exports, and the barrier at the head of Old River on salmon survival. This experimental program is commonly referred to as the VAMP.

Within the SJRA, the IPO has been assumed as the baseline operation for New Melones Reservoir, which forms part of the existing flow condition. The existing flow condition is used to compute the supplemental flows which will be provided on the San Joaquin River to meet the target flows for the 31-day pulse during April and May. These supplemental flows will be provided from other sources in the San Joaquin River Basin under the control of the parties to the SJRA.

The parties to the SJRA include several agencies that contribute flow to the San Joaquin, divert from or store water on the tributaries to the San Joaquin, or have an element of control over the flows in the lower San Joaquin River. These include Reclamation; OID; SSJID; Modesto Irrigation District (ID); Turlock ID; Merced ID; and the San Joaquin River Exchange Contractors. The VAMP is based on coordination among these participating agencies in carrying out their operations to meet a steady target flow objective at Vernalis.

The target flow at Vernalis for the spring pulse flow period is determined each year according to the specifications contained in the SJRA. The target flow is determined prior to the spring pulse flows as an increase above the existing flows, and so “adapts” to the prevailing hydrologic conditions. Possible target flows specified in the agreement are (1) 2000 cfs, (2) 3200 cfs, (3) 4450 cfs, (4) 5700 cfs, and (5) 7000 cfs.

The Hydrology Group develops forecasts of flow at Vernalis, determines the appropriate target flow, devises an operations plan including flow schedules for each contributing agency, coordinates implementation of the VAMP flows, monitors conditions that may affect the objective of meeting the target flow, updates and adjusts the planned flow contributions as needed, and accounts for the flow contributions. The Hydrology Group includes designees with technical expertise from each agency that contributes water to the VAMP. During VAMP, the Hydrology group communicates via regular conference calls, shares current information and forecasts via e-mail and an internet website. The Hydrology group has two lead coordinators, one from Reclamation’s CVO and one designated by the SJRG.

Project operations forecasts include Vernalis flows that meet the appropriate pulse flow targets for the predicted hydrologic conditions. The flows in the San Joaquin River upstream of the Stanislaus River are forecasted for the assumed hydrologic conditions. The upstream of the Stanislaus River flows are then adjusted so when combined with the forecasted Stanislaus River flow based on the IPO, the combined flow would provide the appropriate Vernalis flows consistent with the pulse flow target identified in the SJRA. An analysis of how the flows are produced upstream of the Stanislaus River is included in the SJRA Environmental Impact Statement (EIS)/Environmental Impact Report (EIR). For purposes of Project operations forecasts, the flows are simply assumed to exist at the confluence of the Stanislaus and San Joaquin Rivers, and the assessment of Project operations in the Delta effects begins downstream of that point.

The VAMP program has two distinct components, a flow objective and an export restriction. The flow objectives were designed to provide similar protection to those defined in the WQCP. fishery releases on the Stanislaus above that called for in the 1987 DFG Agreement are typically

considered WQCP (b)(2) releases. The export reduction involves a combined State and Federal pumping limitation on the Delta pumps. The combined export targets for the 31 days of VAMP are specified in the SJRA: 1500 cfs (when target flows are 2000, 3200, 4450, or 7000 cfs), and 2250 cfs (when target flow is 5700 cfs, or 3000 cfs [alternate export target when flow target is 7000 cfs]). Typically, the Federal pumping reduction is considered a WQCP (b)(2) expense and the State reduction is covered by EWA actions. In 2003, however, EWA also provided coverage for the VAMP shoulder portion of the Federal pumping reduction.

### **Water Temperatures**

Water temperatures in the lower Stanislaus River are affected by many factors and operational tradeoffs. These include available cold water resources in New Melones reservoir, Goodwin release rates for fishery flow management and water quality objectives, as well as residence time in Tulloch Reservoir, as affected by local irrigation demand.

The current stated goal for water temperatures in the lower Stanislaus River is 65°F at Orange Blossom Bridge for steelhead incubation and rearing during the late spring and summer. This goal is often unachieved. Fall pulse attraction flows for salmon managed by Service resources helps to transport cold water resources from New Melones Reservoir into Tulloch Reservoir before the spawning season begins.

### **Friant Division**

This division operates separately from the rest of the CVP and is not integrated into the CVP OCAP, but its operation is part of the CVP for purposes of the project description. Friant Dam is located on the San Joaquin River, 25 miles northeast of Fresno where the San Joaquin River exits the Sierra foothills and enters the valley. The drainage basin is 1,676 square miles with an average annual runoff of 1,774,000 af. Completed in 1942, the dam is a concrete gravity structure, 319-feet high, with a crest length of 3,488 feet. Although the dam was completed in 1942, it was not placed into full operation until 1951.

The dam provides flood control on the San Joaquin River, provides downstream releases to meet senior water rights requirements above Mendota Pool, and provides conservation storage as well as diversion into Madera and Friant-Kern Canals. Water is delivered to a million acres of agricultural land in Fresno, Kern, Madera, and Tulare Counties in the San Joaquin Valley via the Friant-Kern Canal south into Tulare Lake Basin and via the Madera Canal northerly to Madera and Chowchilla IDs. A minimum of 5 cfs is required to pass the last water right holding located about 40 miles downstream near Gravelly Ford.

Flood control storage space in Millerton Lake is based on a complex formula, which considers upstream storage in the Southern California Edison reservoirs. The reservoir, Millerton Lake, first stored water on February 21, 1944. It has a total capacity of 520,528 af, a surface area of 4,900 acres, and is approximately 15-miles long. The lake's 45 miles of shoreline varies from gentle slopes near the dam to steep canyon walls farther inland. The reservoir provides boating, fishing, picnicking, and swimming.

## San Felipe Division

Construction of the San Felipe Division of the CVP was authorized in 1967 (Figure 3). The San Felipe Division provides a supplemental water supply (for irrigation, M&I uses) in the Santa Clara Valley in Santa Clara County, and the north portion of San Benito County. It prevents further mining of the groundwater in Santa Clara County and replaces boron-contaminated water in San Benito County.

The San Felipe Division was designed to supply about 216,000 af annually by the year 2020. Water is delivered to the service areas not only by direct diversion from the distribution systems, but also through the expansion of the large groundwater recharge operation now being carried out by local interests. The majority of the water supply, about 150,000 af, is used for M&I purposes. The facilities required to serve Santa Clara and San Benito Counties include 54 miles of tunnels and conduits, two large pumping plants, and one reservoir. About 50 percent of the water conveyed to Santa Clara County is percolated to the underground for agricultural and M&I uses, and the balance is treated for direct M&I delivery. Nearly all of the water provided to San Benito County is delivered via surface facilities. A distribution system was constructed in San Benito County to provide supplemental water to about 19,700 arable acres.

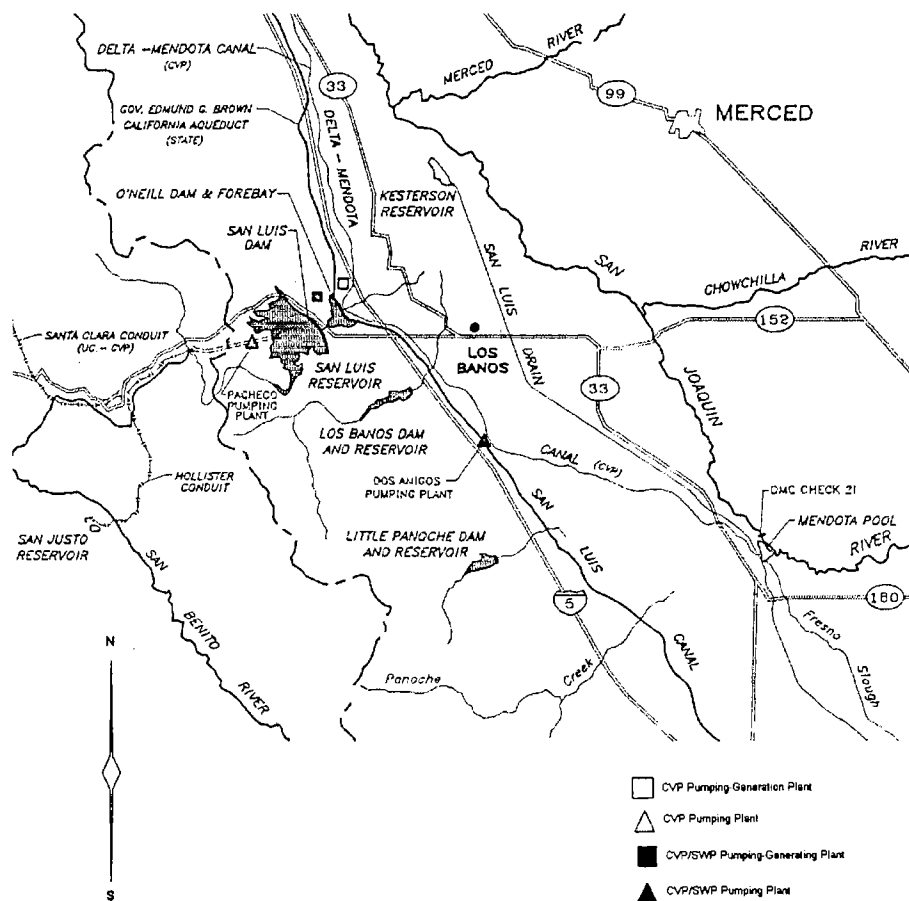


Figure 3 West San Joaquin Division and San Felipe Division

Water is conveyed from the Delta of the San Joaquin and Sacramento Rivers through the DMC. It is then pumped into the San Luis Reservoir and diverted through the 1.8 miles of Pacheco Tunnel Reach 1 to the Pacheco Pumping Plant. Twelve 2,000-horse-power pumps lift a maximum of 480 cfs a distance varying from 85 feet to 300 feet to the 5.3-mile-long Reach 2 of Pacheco Tunnel. The water then flows through the tunnel and without additional pumping, through 29 miles of concrete, high-pressure pipeline, varying in diameter from 10 feet to 8 feet and a mile-long Santa Clara Tunnel. The pipeline terminates at the Coyote Pumping Plant, which is capable of pumping water to Coyote Creek or the Calero Reservoir.

Santa Clara Valley Water District operates the Pacheco Tunnel, Pacheco Pumping Plant, Santa Clara Tunnel and Coyote Pumping Plant.

The Hollister Conduit branches off the Pacheco Conduit 8 miles from the outlet of the Pacheco Tunnel. This 19.1-mile-long high-pressure pipeline, with a maximum capacity of 83 cfs, terminates at the San Justo Reservoir.

The 9,906 af capacity San Justo Reservoir is located about three miles southwest of the City of Hollister. The San Justo Dam is an earthfill structure 141-feet high with a crest length of 722 feet. This project includes a dike structure 66-feet high with a crest length of 918 feet. This reservoir regulates San Benito County's import water supplies, allows pressure deliveries to some of the agricultural lands in the service area, and provides storage for peaking of agricultural water.

The San Benito County Water District operates San Justo Reservoir and the Hollister Conduit.

## **State Water Project**

The DWR holds contracts with 29 public agencies throughout Central and Southern California for water supplies from the SWP. Water stored in the Oroville facilities, along with surplus water from the Sacramento-San Joaquin Delta are captured in the Delta and conveyed through several facilities to SWP contractors. The operation of these facilities is the subject of this project description. The facilities include the primary conservation storage complex on the Feather River, export facilities located in the North and South Delta, tidally operated gates in the Suisun Marsh, and operable barriers in the South Delta.<sup>4</sup>

## **Feather River**

### ***SWP Oroville Facilities***

Oroville Dam and its appurtenances comprise a multipurpose project encompassing water conservation, power generation, flood control, recreation, and fish and wildlife enhancement. Oroville Lake stores winter and spring runoff that is released into the Feather River, as necessary,

---

<sup>4</sup> Permanent operable barriers are planned for future construction and operation. Only the operation of these facilities is included in this project description. Construction effects will be addressed through a separate consultation process.

The Oroville facilities are shown in Figure 4. Two small embankments, Bidwell Canyon and Parish Camp Saddle Dams, complement Oroville Dam in containing Lake Oroville. The lake has a surface area of 15,858 acres, a storage capacity of 3,538,000 af, and is fed by the North, Middle, and South forks of the Feather River. Average annual unimpaired runoff into the lake is about 4.5 million af.

Approximately 4 miles downstream of Oroville Dam and Edward Hyatt Powerplant is the Thermalito Diversion Dam. Thermalito Diversion Dam consists of a 625-foot-long, concrete gravity section with a regulated ogee spillway that releases water to the low flow channel of the Feather River. On the right abutment is the Thermalito Power Canal regulating headwork structure.



The purpose of the diversion dam is to divert water into the 2-mile long Thermalito Power Canal that conveys water in either direction and creates a tailwater pool (called Thermalito Diversion Pool) for Edward Hyatt Powerplant. The Thermalito Diversion Pool acts as a forebay when Hyatt is pumping water back into Lake Oroville. On the left abutment is the Thermalito Diversion Dam Powerplant, with a capacity of 600 cfs that releases water to the low-flow section of the Feather River.

Thermalito Power Canal hydraulically links the Thermalito Diversion Pool to the Thermalito Forebay (11,768 af), which is the off-stream regulating reservoir for Thermalito Powerplant. Thermalito Powerplant is a generating-pumping plant operated in tandem with the Edward Hyatt Powerplant. Water released to generate power in excess of local and downstream requirements is conserved in storage and, at times, pumped back through both powerplants into Lake Oroville during off-peak hours. Energy price and availability are the two main factors that determine if a pumpback operation is economical. A pumpback operation most commonly occurs when energy prices are high during the weekday on-peak hours and low during the weekday off-peak hours or on the weekend. The Oroville Thermalito Complex has a capacity of approximately 17,000 cfs through the powerplants, which can be returned to the Feather River via the Afterbay's river outlet.

Local agricultural districts divert water directly from the afterbay. These diversion points are in lieu of the traditional river diversion exercised by the local districts whose water rights are senior to the SWP. The total capacity of afterbay diversions during peak demands is 4,050 cfs.

The DFG operates the Feather River Fish Hatchery for the production of Chinook salmon and steelhead. The hatchery is located downstream of the Thermalito Diversion Dam. Water is provided to the hatchery via a pipeline from the diversion dam. The Feather River Fish Barrier Dam is downstream of the Thermalito Diversion Dam and immediately upstream of the Feather River Fish Hatchery. The flow over the dam maintains fish habitat in the low-flow channel of the Feather River between the dam and the afterbay outlet. The Fish Barrier Dam prevents further upstream migration by adult salmon and steelhead and helps direct them to the fish ladder entrance located on the right (west) embankment.

### **Temperature Control**

The August 1983 agreement between DWR and DFG, "Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish & Wildlife," (Reclamation 2004) sets criteria for flow and temperature for the low-flow section of the Feather River, the fish hatchery, and the reach of the Feather River below the river outlet to the confluence with the Sacramento River.

### **Flood Control**

Flood control operations at Oroville Dam are conducted in coordination with DWR's Flood Operations Center and in accordance with the requirements set forth by the Corps. The Federal Government shared the expense of Oroville Dam, which provides up to 750,000 af of flood

control space. The spillway is located on the right abutment of the dam and has two separate elements: a controlled gated outlet and an emergency uncontrolled spillway. The gated control structure releases water to a concrete-lined chute that extends to the river. The uncontrolled emergency spill flows over natural terrain.

**Table 8 Water Year/Days in Flood Control/40-30-30 Index**

<b>Water Year</b>	<b>Days in Flood Control</b>	<b>40-30-30 Index</b>
1981	0	D
1982	35	W
1983	51	W
1984	16	W
1985	0	D
1986	25	W
1987	0	D
1988	0	C
1989	0	D
1990	0	C
1991	0	C
1992	0	C
1993	8	AN
1994	0	C
1995	35	W
1996	22	W
1997	57	W
1998	0	W
1999	58	W
2000	0	AN
2001	0	D
2002	0	D

### **DWR Feather River Fish Studies**

DWR initiated fish studies in the lower Feather River in 1991. The present program consists of several elements to monitor salmonid spawning, rearing, and emigration and to document presence and relative abundance of non-salmonid fishes. The focus and methods used for these studies were altered in 2003 as a result of consultations with NOAA Fisheries, DFG, and others to gather information needed to relicense the Oroville facilities with the Federal Energy Regulatory Commission (FERC).

### **SWP/CVP Delta Facilities**

## **CVP Facilities**

The CVP's Delta Division includes the DCC, the CCWD diversion facilities, the Tracy Pumping Plant, the TFCF, and the DMC. The DCC is a controlled diversion channel between the Sacramento River and Snodgrass Slough. The CCWD diversion facilities use CVP water resources to serve district customers directly and to operate CCWD's Los Vaqueros Project. The Tracy Pumping Plant diverts water from the Delta to the head of the DMC.

### ***Delta Cross Channel operations***

The DCC is a gated diversion channel in the Sacramento River near Walnut Grove and Snodgrass Slough. Flows into the DCC from the Sacramento River are controlled by two 60-foot by 30-foot radial gates. When the gates are open, water flows from the Sacramento River through the cross channel to channels of the lower Mokelumne and San Joaquin Rivers toward the interior Delta. The DCC operation improves water quality in the interior Delta by improving circulation patterns of good quality water from the Sacramento River towards Delta diversion facilities.

Reclamation operates the DCC in the open position to (1) improve the transfer of water from the Sacramento River to the export facilities at the Banks and Tracy Pumping Plants, (2) improve water quality in the southern Delta, and (3) reduce salt water intrusion rates in the western Delta. During the late fall, winter, and spring, the gates are often periodically closed to protect out-migrating salmonids from entering the interior Delta. In addition, whenever flows in the Sacramento River at Sacramento reach 20,000 to 25,000 cfs (on a sustained basis) the gates are closed to reduce potential scouring and flooding that might occur in the channels on the downstream side of the gates.

Flow rates through the gates are determined by Sacramento River stage and are not affected by export rates in the south Delta. The DCC also serves as a link between the Mokelumne River and the Sacramento River for small craft, and is used extensively by recreational boaters and fishermen whenever it is open. Because alternative routes around the DCC are quite long, Reclamation tries to provide adequate notice of DCC closures so boaters may plan for the longer excursion.

The D-1641 DCC standards provide for closure of the DCC gates for fisheries protection at certain times of the year. From November through January, the DCC may be closed for up to 45 days for fishery protection purposes. From February 1 through May 20, the gates are closed for fishery protection purposes. The gates may also be closed for 14 days for fishery protection purposes during the May 21 through June 15 period. Reclamation determines the timing and duration of the closures after consultation with Service, DFG, and NOAA Fisheries. Consultation with the CALFED Ops Group will also satisfy the consultation requirement.

The CALFED Ops Group typically relies on monitoring for fish presence and movement in the Sacramento River and Delta, the salvage of salmon at the Tracy and Skinner facilities, and hydrologic cues for the timing of DCC closures, subject also to current water quality conditions in the interior and western Delta. From mid-June to November, Reclamation usually keeps the

gates open on a continuous basis. The DCC is also usually opened for the busy recreational Memorial Day weekend, if this is possible from a fishery, water quality, and flow standpoint.

The Salmon Decision Process (see Appendix B of the BA) included “Indicators of Sensitive Periods for Salmon” such as hydrologic changes, detection of spring-run salmon or spring-run salmon surrogates at monitoring sites or the salvage facilities, and turbidity increases at monitoring sites to trigger the Salmon Decision Process. In November 2000, the previously entitled Spring Run Protection Plan was replaced by a CALFED Ops Group plan (Reclamation 2004) designed to provide broader protections for juvenile salmon emigrating through the Delta from October through January.

The Salmon Decision Process is used by the fishery agencies and project operators to facilitate the often complex coordination issues surrounding DCC gate operations and the purposes of fishery protection closures, Delta water quality, and/or export reductions. Inputs such as fish lifestage and size development, current hydrologic events, fish indicators (such as the Knight’s Landing Catch Index and Sacramento Catch Index), and salvage at the export facilities, as well as current and projected Delta water quality conditions, are used to determine potential DCC closures and/or export reductions. The coordination process has worked well during the recent fall and winter DCC operations and is expected to be used in the present or modified form in the future.

### ***Tracy Pumping Plant***

The Projects use the Sacramento River and Delta channels to transport water to export pumping plants in the south Delta. The CVP’s Tracy Pumping Plant, about five miles north of Tracy, consists of six available pumps. The Tracy Pumping Plant is located at the end of an earth-lined intake channel about 2.5 miles long. At the head of the intake channel, louver screens (that are part of the TFCF) intercept fish, which are then collected and transported by tanker truck to release sites away from the pumps. Tracy Pumping Plant diversion capacity is approximately 4,600 cfs during the peak of the irrigation season and approximately 4,200 cfs during the winter non-irrigation season before the Intertie, described on page 88. The capacity limitations at the Tracy Pumping Plant are the result of a DMC freeboard constriction near O’Neill Forebay, O’Neill Pumping Plant capacity, and the current water demand in the upper sections of the DMC.

### ***Tracy Fish Collection Facility***

The TFCF uses behavioral barriers consisting of primary and secondary louvers to guide targeted fish into holding tanks before transport by truck to release sites within the Delta. Hauling trucks used to transport salvaged fish to release sites contain an eight parts per thousand salt solution to reduce stress. The CVP uses two release sites, one on the Sacramento River near Horseshoe Bend and the other on the San Joaquin River immediately upstream of the Antioch Bridge. During a facility inspection a few years ago, TFCF personnel noticed significant decay of the transition boxes and conduits between the primary and secondary louvers. The temporary rehabilitation of these transition boxes and conduits was performed during the fall and winter of 2002. Extensive rehabilitation of the transition boxes and conduits was completed during the San Joaquin pulse period of 2004.

When compatible with export operations, and technically feasible, the louvers are operated with the objective of achieving water approach velocities: for stripped bass of approximately 1 foot per second (ft/s) from May 15 through October 31, and for salmon of approximately 3 ft/s from November 1 through May 14. Channel velocity criteria are a function of bypass ratios through the facility.

Fish passing through the facility are sampled at intervals of no less than 10 minutes every 2 hours. Fish observed during sampling intervals are identified to species, measured to fork length, examined for marks or tags, and placed in the collection facilities for transport by tanker truck to the release sites away from the pumps.

Studies will also be conducted at the TFCF to help determine screening criteria and improve delta smelt handling and survival in the salvage process.

### ***Contra Costa Water District Diversions Facilities***

CCWD diverts CVP water from the Delta for irrigation and M&I uses. Prior to 1997, CCWD's primary diversion facility in the Delta originated at Rock Slough, about four miles southeast of Oakley. At Rock Slough, the water is lifted 127 feet by a series of four pumping plants into the Contra Costa Canal (CCC), a 47.7-mile canal that terminates in Martinez Reservoir. Two short canals, Clayton and Ygnacio, are integrated into the distribution system. The Clayton Canal is no longer in service

Rock Slough diversion capacity of 350 cfs gradually decreases to 22 cfs at the terminus. Historically, actual Rock Slough pumping rates have ranged from about 50 to 250 cfs with seasonal variation. Rock Slough Pumping Plant is an unscreened facility. The fish-screening of the Rock Slough Pumping Plant is directed under the CVPIA and is included in the CCWD's BO for the Los Vaqueros Project (Service 1993b). Reclamation, in collaboration with CCWD, is responsible for constructing the fish screen. Reclamation asked for an extension until December 2008 to allow completion of current CALFED project studies that might affect frequency of usage of the Rock Slough intake and therefore, the screen design.

As part of the Los Vaqueros Project, CCWD also diverts from the Delta on Old River near Highway 4 at a fish-screened diversion facility with a capacity of 250 cfs. The Los Vaqueros Project was constructed to improve the delivered water quality and emergency storage reliability to CCWD's customers. The Old River facility allows CCWD to directly divert up to 250 cfs of CVP water to a blending facility with the existing CCC, in addition to the Rock Slough direct diversions. The Old River facility can also divert up to 200 cfs of CVP and Los Vaqueros water rights water for storage in the 100,000 af Los Vaqueros Reservoir.

The water rights for the Los Vaqueros Project were approved by SWRCB Decision 1629 (Reclamation 2004). A NOAA Fisheries BO for the Los Vaqueros winter-run Chinook salmon was provided on March 18, 1993 (Reclamation 2004). A Service BO for Los Vaqueros (Service 1993b) covering delta smelt was provided on September 9, 1993 and clarified by letter on September 24, 1993. The Service BO requires CCWD to preferentially divert CVP water from the fish-screened Old River intake from January through August each year.

The Service BO also requires CCWD to operate all three of its intakes (including CCWD's Mallard Slough intake) and Los Vaqueros Reservoir as an integrated system to minimize impacts to endangered species. The 1993 BO calls for monitoring at all three intakes to determine diversion of water at Rock Slough, Old River, and Mallard Slough to minimize take of delta smelt during the spawning and rearing period.

Due to the water quality objectives of the Los Vaqueros Project, CCWD's total diversions from the Delta are reduced during the late summer and fall when Delta water quality and flows are the poorest of the annual cycle. The CCWD fills the Los Vaqueros Reservoir only when Delta water quality conditions are good, which generally occurs from January to July.

Additionally, under the Los Vaqueros BOs, CCWD is required to cease all diversions from the Delta for 30 days in the spring if stored water is available in Los Vaqueros Reservoir above emergency storage levels and to use releases from the reservoir to meet CCWD demands. To provide additional fisheries protection, CCWD is not allowed to divert water to Los Vaqueros storage for an additional 45-day period in the winter or spring months.

The CCWD's third diversion facility in the Delta is located at the southern end of a 3,000-foot-long channel running due south of Suisun Bay, near Mallard Slough (across from Chipps Island). The old Mallard Slough Pump Station was replaced in 2002 with a new pump station that has a state-of-the-art fish screen. The Mallard Slough Pump Station can pump up to 39.3 cfs, but is only used by CCWD during periods of very high Delta outflows (about 40,000 cfs or greater), when the water quality is good enough in Suisun Bay to meet CCWD's delivered chloride goal of 65 mg/L.

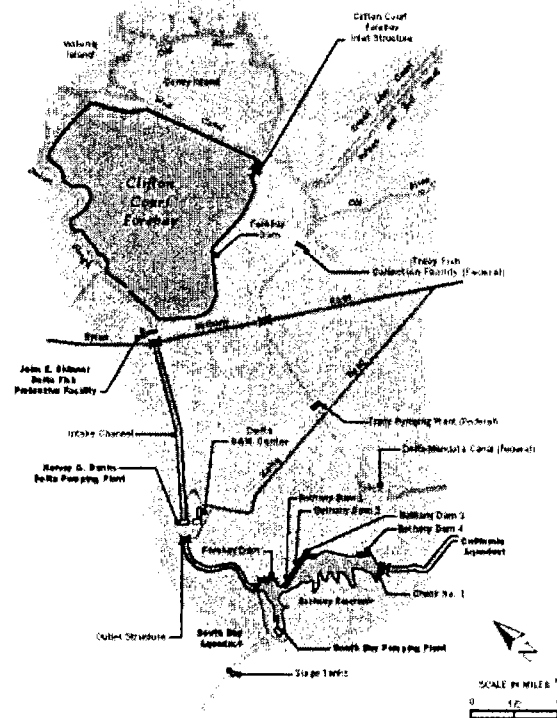
The CCWD has one license and one permit for Diversion and Use of Water issued by the SWRCB, which authorize CCWD to divert up to 26,780 af per year at Mallard Slough (Reclamation 2004). Although the Mallard Slough intake is very small and is only used under extremely high Delta outflow conditions, it is an integral part of CCWD's operations. In 2003, CCWD used Mallard Slough (in conjunction with storage in Reclamation's Contra Loma Reservoir) to optimize its ability to fill Los Vaqueros Reservoir while the Rock Slough intake was out of service for replacement of a section of the CCC. All three Delta intake facilities are being considered in this project description chapter.

### **Project Delta Export Facilities Operations Coordination**

The Delta serves as a natural system of channels to transport river flows and reservoir storage to the Project facilities in the south Delta, which export water to the Projects' service areas. Reclamation and DWR closely coordinate the operations of the Tracy and Banks Pumping Plants with operations of the joint CVP and SWP San Luis Reservoir near Los Banos (Figure 6). The Tracy Pumping Plant is usually operated at a constant and uninterrupted rate. When water supply supports it, the Tracy Pumping Plant is usually operated to the capacity limits of the DMC, except when restrictions are imposed by regulatory or fishery requirements. Currently, maximum daily diversions into the Clifton Court Forebay (CCF) are governed by agreement with the Corps.

Between mid-December and mid-March, an additional amount of water may be diverted equal to one-third of the San Joaquin River (as measured at Vernalis) when the river flow is 1,000 cfs or greater. The CCF is operated to minimize effects to water levels during the low-low tide of the day. Banks Pumping Plant has 11 fixed-speed pumps of varying size, which are run to the extent possible during off-peak power periods to convey water into the CA.

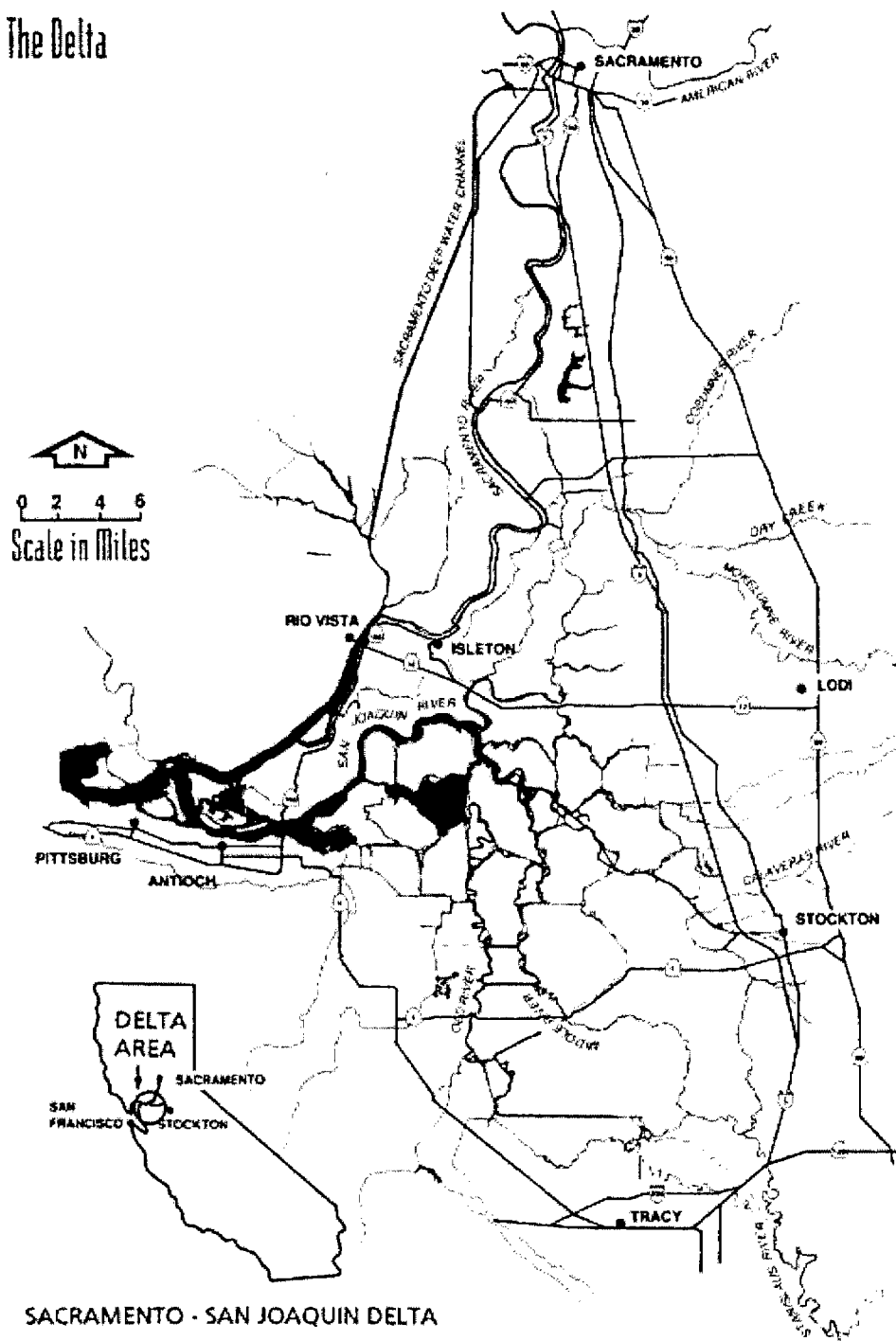
# CLIFTON COURT FOREBAY AND FOREBAY GENERAL PLAN



### Figure 6 CCF, Tracy and Banks Pumping Plants

<sup>5</sup>Up to an additional 500 cfs of diversion may be allowed from July through September as part of the Environmental Water Account operations. See the section titled “The CALFED Environmental Water Account” for further details.

## The Delta



### Figure 7 Sacramento-San Joaquin Delta

## Sacramento-San Joaquin Delta- SWP Facilities

SWP facilities in the southern Delta include CCF, John E. Skinner Fish Facility, and the Harvey O. Banks Pumping Plant. CCF is a 31,000 af reservoir located in the southwestern edge of the Delta, about 10 miles northwest of Tracy. CCF provides storage for off-peak pumping,

moderates the effect of the pumps on the fluctuation of flow and stage in adjacent Delta channels, and collects sediment before it enters the CA. Diversions from Old River into CCF are regulated by five radial gates.

The John E. Skinner Delta Fish Protective Facility is located west of the CCF, 2 miles upstream of the Harvey O. Banks Delta Pumping Plant. The Skinner Fish Facility screens fish away from the pumps that lift water into the CA. Large fish and debris are directed away from the facility by a 388-foot-long trash boom. Smaller fish are diverted from the intake channel into bypasses by a series of metal louvers, while the main flow of water continues through the louvers and towards the pumps. These fish pass through a secondary system of screens and pipes into seven holding tanks, where they are later counted and recorded. The salvaged fish are then returned to the Delta in oxygenated tank trucks.

The Harvey O. Banks Delta Pumping Plant is in the South Delta, about 8 miles northwest of Tracy and marks the beginning of the CA. By means of 11 pumps, including 2 rated at 375 cfs capacity, 5 at 1,130 cfs capacity, and 4 at 1,067 cfs capacity, the plant provides the initial lift of water 244 feet into the CA. The nominal capacity of the Banks Pumping Plant is 10,300 cfs.

Other SWP operated facilities in and near the Delta include the North Bay Aqueduct (NBA), the Suisun Marsh Salinity Control Gates (SMSCG), Roaring River Distribution System (RRDS), and up to four temporary barriers in the south Delta. Each of these facilities is discussed further in later sections.

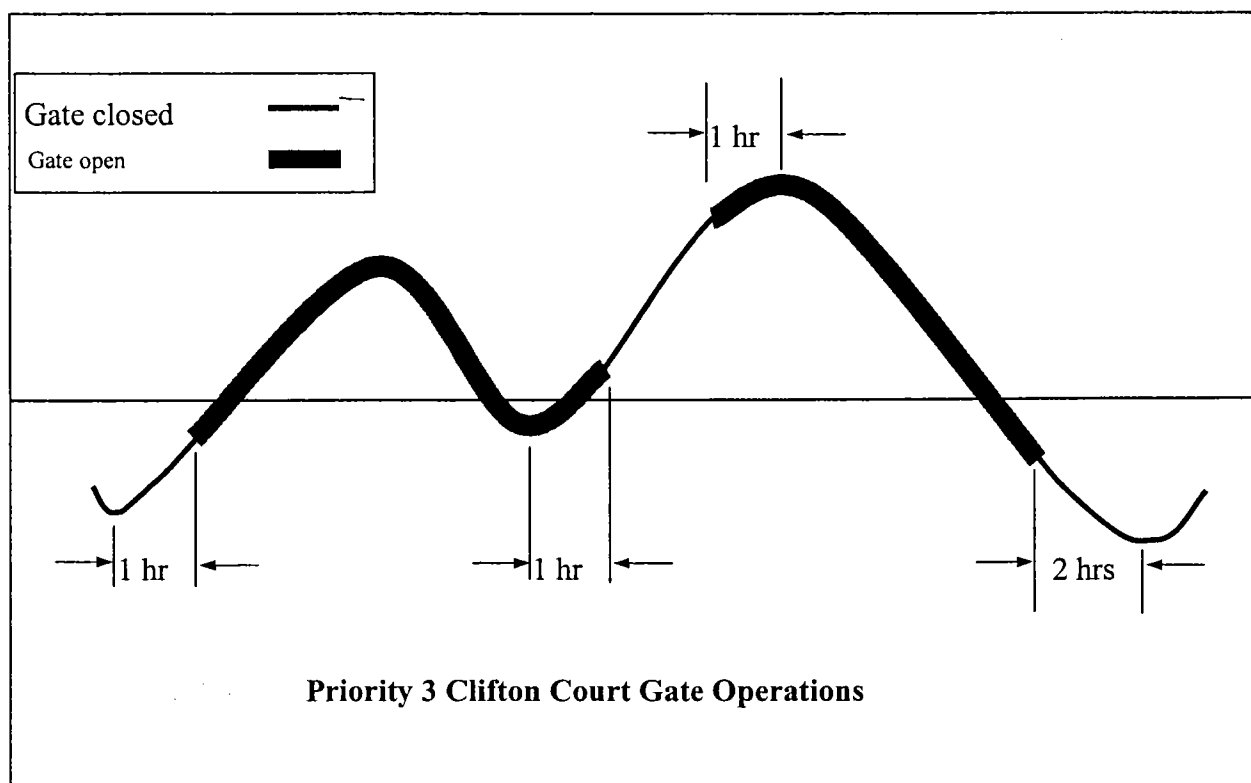
Since its conception the State Water Project's water supply has been highly dependent upon unregulated flow into the Delta. The delivery of water within the SWP in any given year is a function of operational requirements, Project storage conditions, demands (and the pattern of those demands), and the availability of unregulated flow into the Delta. To the extent that unregulated water has been available in the Delta, beyond that necessary to meet scheduled Project purposes and obligations, said water has been made available to any contractor who can make use of it. The original water supply contracts for SWP contractors included various labels for this Project water depending on the intended use—including the prominently used label of "interruptible".

In 1994, the contracts were amended in what is commonly referred to as the Monterey Amendment (Reclamation 2004). The basic objective of the amendment was to improve the management of SWP supplies—it did not affect the Project operations in the Delta or on the Feather River. Article 21 of the amendment stipulates that any SWP contractor is entitled to water available to the SWP when excess water to the Delta exceeds the Project's need to fulfill scheduled deliveries, meet operational requirements, or meet storage goals for the current or following years. This includes the water that was before known as "interruptible" as well as some other lesser known labels of water diverted under the same conditions. Article 21 water is and always has been an important source of water for various contractors during the wet winter months and is used to fill groundwater storage and off-stream reservoirs in the SWP service areas. It is also used to pre-irrigate croplands thereby preserving groundwater and local surface water supplies for later use during dry periods.

### Clifton Court Forebay

CCF is a regulated reservoir at the head of the CA in the south Delta. Inflows to the CCF are controlled by radial gates, which are generally operated during the tidal cycle to reduce approach velocities, prevent scour in adjacent channels, and minimize impacts to water level in the south Delta. Generally, the concern is potential effects to the lower of the two low tides in during the day; thus, the gates are operated in a manner to reduce the impact to this low tide condition.

When a large head differential exists between the outside and the inside of the gates, theoretical inflow can be as high as 15,000 cfs for a short time. However, existing operating procedures identify a maximum design rate of 12,000 cfs, which prevents water velocities from exceeding three ft/s to control erosion and prevent damage to the facility. Figure 8 shows an example of when the gates could be opened and still minimize impacts to the lowest tide of the day.



**Figure 8 Clifton Court Gate Operations**

### North Bay Aqueduct Intake at Barker Slough

The Barker Slough Pumping Plant diverts water from Barker Slough into the NBA for delivery in Napa and Solano Counties. Maximum pumping capacity is 175 cfs (pipeline capacity). During the past few years, daily pumping rates have ranged between 0 and 140 cfs.

The NBA intake is located approximately 10 miles from the main stem Sacramento River at the end of Barker Slough. Each of the ten NBA pump bays is individually screened with a positive

barrier fish screen consisting of a series of flat, stainless steel, wedge-wire panels with a slot width of 3/32 inch. This configuration is designed to exclude fish 25 millimeters (mm) or larger from being entrained. The bays tied to the two smaller units have an approach velocity of about 0.2 ft/s. The larger units were designed for a 0.5 ft/s approach velocity, but actual approach velocity is about 0.44 ft/s. The screens are routinely cleaned to prevent excessive head loss, thereby minimizing increased localized approach velocities.

Delta smelt monitoring presently required at Barker Slough under the March 6, 1995 OCAP Biological Opinion (Service 1995). Since 1995, monitoring has been required every other day at three sites from mid-February through mid-July, when delta smelt may be present. As part of the Interagency Ecological Program (IEP), DWR has contracted with the Department of Fish and Game to conduct the required monitoring each year since the Biological Opinion was issued.

A recent review by the IEP indicates that the present NBA monitoring program is not very effective for the management of smelt. Data from the past 9 years of monitoring show that catch of delta smelt in Barker Slough has been consistently very low, an average of just five percent of the values for nearby north Delta stations (Cache, Miner and Lindsey sloughs) (see Figure 12). These results are discussed in further detail in the effects section.

Based on these findings, the Working Group has recommended a broader regional survey during the primary period when delta smelt are most vulnerable to water project diversions. An alternative sampling approach would be conducted as a 1-2 year pilot effort in association with the DFG's existing 20-mm survey (<http://www.delta.dfg.ca.gov/data/20mm>). The survey would cover all existing 20-mm stations, but would have an earlier seasonal start and stop date to focus on the presence of larvae in the Delta. The proposed gear type is a surface boom tow, as opposed to oblique sled tows that have traditionally been used to sample larval fishes in the San Francisco Estuary. Under the proposed work plan, the Working Group will evaluate utility of the study and effectiveness of the gear in each year of the pilot work.

### **South Delta Temporary Barriers**

The South Delta Temporary Barriers (SDTB) are not a project element for purposes of this biological assessment or the resulting consultation. A description of the SDTB is included only to provide information on a related project. A separate biological assessment has been prepared for the Temporary Barriers Project (DWR 1999a).

The existing SDTB Project consists of installation and removal of temporary rock barriers at the following locations:

- Middle River near Victoria Canal, about 0.5 miles south of the confluence of Middle River, Trapper Slough, and North Canal
- Old River near Tracy, about 0.5 miles east of the DMC intake
- Grant Line Canal near Tracy Boulevard Bridge, about 400 feet east of Tracy Boulevard Bridge

- The head of Old River at the confluence of Old River and San Joaquin River

The barriers on Middle River, Old River near Tracy, and Grant Line Canal are tidal control facilities designed to improve water levels and circulation for agricultural diversions and are in place during the growing season. Installation and operation of the barriers at Middle River and Old River near Tracy can begin May 15, or as early as April 15 if the spring head of Old River barrier is in place. From May 16 to May 31 (if the head of Old River barrier is removed) the tide gates are tied open at both Middle River and Old River near the Tracy barriers. After May 31, the Middle River, the Old River near Tracy, and the Grant Line Canal barriers are permitted to be operational until September 30.

During the spring, the barrier at the head of Old River is designed to reduce the number of out-migrating salmon smolts entering Old River. During the fall, the head of Old River barrier is designed to improve flow and DO conditions in the San Joaquin River for the immigration of adult fall-run Chinook salmon. Operations of the head of Old River barrier are typically between April 15 to May 15 for the spring barrier, and between early September to late November for the fall barrier. Installation and operation of the barrier also depend on San Joaquin flow conditions. DWR was permitted to install and operate these barriers between 1992 and 2000. In 2001, DWR obtained approvals to extend the Temporary Barriers Project for an additional 7 years.

## **West San Joaquin Division**

### **San Luis Operations**

As part of the West San Joaquin Division, the San Luis Unit was authorized in 1960 to be built and operated jointly with the State of California. The San Luis Unit consists of the following: (1) Sisk San Luis Dam and San Luis Reservoir, joint Federal-State facilities; (2) O'Neill Dam and Forebay, joint Federal-State facilities; (3) O'Neill Pumping-Generating Plant, a Federal facility; (4) William R. Gianelli Pumping-Generating Plant, a joint Federal-State facility; (5) San Luis Canal, a joint Federal-State facility; (6) Dos Amigos Pumping Plant, a joint Federal-State facility; (7) Coalinga Canal, a Federal facility; (8) Pleasant Valley Pumping Plant, a Federal facility; and (9) the Los Banos and Little Panoche Detention Dams and Reservoirs, joint Federal-State facilities).

The management of the San Luis Unit depends on the operation of the northern features of the CVP, while simultaneously influencing the operation of the northern CVP system. This relationship results from the need to deliver about half of the CVP's annual water supply through the DMC and the San Luis Unit, while essentially all of the water supply must originate from the northern Central Valley.

To accomplish the objective of providing water to CVP contractors in the San Joaquin Valley, three conditions must be considered: (1) water demands and anticipated water schedules for CVP water service contractors and exchange contractors must be determined; (2) a plan to fill and draw down San Luis Reservoir must be made; and (3) coordinating Delta pumping and using San

Luis Reservoir must be established. Only after these three conditions are made can the CVP operators incorporate the DMC and San Luis operations into plans for operating the northern CVP system.

### ***Water Demands--DMC and San Luis Unit***

Water demands for the DMC and San Luis Unit are primarily composed of three separate types: CVP water service contractors, exchange contractors, and wildlife refuge contracts. A significantly different relationship exists between Reclamation and these three groups. Exchange contractors "exchanged" their senior rights to water in the San Joaquin River for a CVP water supply from the Delta. Reclamation thus guaranteed the exchange contractors a firm water supply of 840,000 af per annum, with a maximum reduction under defined hydrologic conditions of 25 percent.

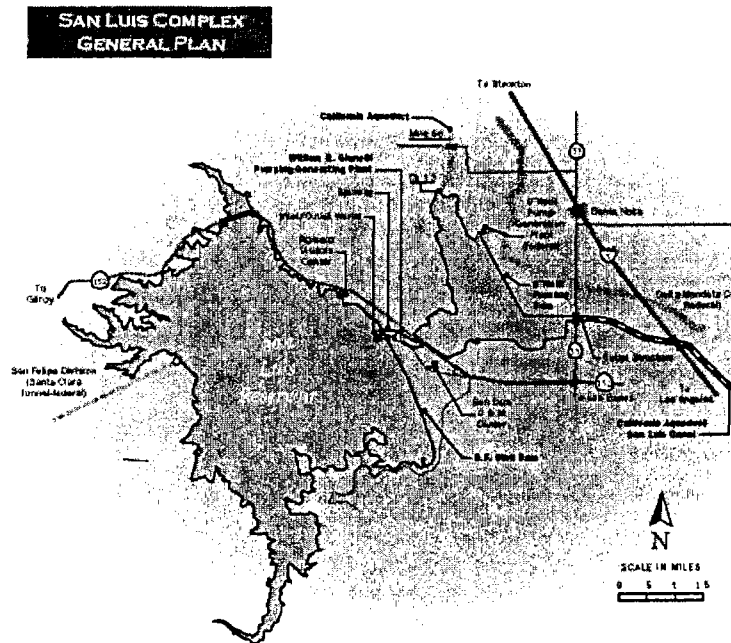
Agricultural water service contractors also receive their supply from the Delta, but their supplies are subject to the availability of CVP water supplies that can be developed and reductions in contractual supply can exceed 25 percent.

Wildlife refuge contracts provide water supplies to specific managed lands for wildlife purposes and the CVP contract water supply can be reduced under critically dry conditions by up to 25 percent.

Combining the contractual supply of these three types of contractors with the pattern of requests for water is necessary to achieve the best operation of the CVP. In most years, because of reductions in CVP water supplies due to insufficient Delta pumping capability, sufficient supplies are not available to meet all water demands. In some dry or drought years, water deliveries are limited because of insufficient northern CVP reservoir storage to meet all in-stream fishery objectives, including water temperatures, and to use the delivery capacity of Tracy Pumping Plant. The scheduling of water demands, together with the scheduling of the releases of supplies from the northern CVP to meet those demands, is a CVP operational objective intertwined with the Trinity, Sacramento, and American River operations.

### ***San Luis Reservoir Operations***

Two means of moving water from its source in the Delta are available for the DMC and the San Luis Unit (Figure 9). The first is Reclamation's Tracy Pumping Plant, which pumps water into the DMC. The second is the State's Banks Pumping Plant, which pumps water into the CA. During the spring and summer, water demands and schedules are greater than Reclamation's and DWR's capability to pump water at these two facilities, and water stored in the San Luis Reservoir must be used to make up the difference.



**Figure 9 San Luis Complex**

The San Luis Reservoir has very little natural inflow, therefore, if it is to be used for a water supply, the water must be stored during the fall and winter months when the two pumping plants can export more water from the Delta than is needed for scheduled water demands. Because the amount of water that can be exported from the Delta is limited by available water supply, Delta constraints, and the capacities of the two pumping plants, the fill and drawdown cycle of San Luis Reservoir is an extremely important element of CVP operations.

Adequate storage in San Luis Reservoir must be maintained to ensure delivery capacity through Pacheco Pumping Plant to the San Felipe Division. Lower reservoir elevations can also result in turbidity and water quality treatment problems for the San Felipe Division users.

A typical San Luis Reservoir annual operation cycle starts with the CVP's share of the reservoir storage nearly empty at the end of August. Irrigation demands decrease in September and the opportunity to begin refilling San Luis Reservoir depends on the available water supply in the northern CVP reservoirs and the pumping capability at Tracy Pumping Plant that exceeds water demands. Tracy Pumping Plant operations generally continue at the maximum diversion rates until early spring, unless San Luis Reservoir is filled or the Delta water supply is not available. As outlined in the Interior's Decision on Implementation of Section 3406 (b)(2) of the CVPIA